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ABSTRACT

The Organization for Economic Co-operation and Development (OECD) report consists of a collection of essays concerned with the relationship between earnings and education. One of its purposes was to collect the diverse sources of earnings classified by education in OECD countries. but the more important purpose was methodological. Thus, the major part of the volume is devoted to a review of four aspects of the relationship between earnings differentials and level of schooling: (1) the role of student ability, (2) the role of school quality in determining earnings, (3) the extent of monopoly elements in earnings by level of education, and (4) fringe benefits by educational level. In particular the OECD report discusses the issues and possible analyses ralated to education and earnings, analyzes the above-mentioned four special topics associated with the interpretation of earnings by educational level, documents the sources and presents in summary form whatever data are available on earnings by education in OECD countries, and points at some areas of future research. An appendix gives more detailed tabulations of earnings by education and documents the sources of such data in a number of countries. The document concludes with a four-page bibliography. (Author/BP)

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EARNINGS AND EDUCATION
IN OECD COUNTRIES

by

George Psacharopoulos

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TABLE OF CONTENTS

Acknowledgements		2
Chapter 1	Introduction	3
2	Why Examine Earnings Differentials?	6
3	Ability Adjustments	18
4	Effects of Variations in School Quality	62
5	Monopoly Elements in Earnings from Education	96
6	The Fringe Benefits of Education	134
7	International Earnings Patterns	162
8	Conclusion	171
Appendix	Country Tables and Data Sources	179

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It might be needless to underline that the opinions expressed in this volume are entirely mine, and they are not necessarily endorsed by the above persons or the O.E.C.D.

George Psacharopoulos

Chapter 1

INTRODUCTION

The O.E.C.D. has had a long interest in education. Thus far, the Organisation's work relating to education has mostly been concentrated on numbers of the population, labour force or students classified by educational level. Quality and price considerations have been limited to the cost side of producing education. This study complements earlier O.E.C.D. work by focusing on the value of the benefits of education as reflected in the labour market for qualified manpower. Simultaneous consideration of price and quality should permit better understanding of the socio-economic role of education.

There is already a substantial body of statistics on earnings and education around the world. One of the purposes of this volume is to collect the diverse sources on earnings classified by education in O.E.C.D. countries. But the more important purpose is methodological. The major part of this volume is devoted to a review of four aspects of the relationship between earnings differentials and level of schooling. These aspects are, firstly the role of student ability, secondly of school quality in determining earnings, thirdly the extent of monopoly elements in earnings by level of education, and fourthly fringe benefits by educational level.

To put it differently, this volume consists of a collection of essays on the same theme. The theme is the relationship between earnings and education. The essays range from theoretical considerations on why this relationship is important, to sources of earnings-by-education data in O.E.C.D. countries. In particular, we:

a. discuss the issues and possible analyses related to education and earnings,

b. analyse the above-mentioned four special topics associated with the interpretation of earnings by educational level,

c. document the sources and present in a summary form whatever data are available on earnings by education in O.E.C.D. countries, and

d. point at some areas of future research.

The next chapter gives the rationale why one should look at earnings by education and how these data can be used for the formulation of policy. The discussion proceeds in terms of the efficiency-equity-unemployment headings, although there exists considerable overlap between classifications.

The following four chapters (3,4,5 and 6) consider an equal number of special topics one should be aware of when using crude earnings differentials. These topics were chosen according to a normative judgment of what are some key or priority issues in this field. Chapter 3 looks at the ability dimension of education. To what extent are earnings differentials by educational level due to education itself, relative to superior ability of those with higher educational level? Chapter 4 deals with the quality dimension of education. This is another area of recent research activity. The question we ask in that chapter is how much better school quality is worth in terms of extra earnings. Chapter 5 deals with the subject of monopoly incomes. Observed earnings differentials might be due to monopoly power enjoyed by a part of employed persons rather than to the education they have received. To what extent is this true? The wage or salary element is only part of the economic reward derived from employment. In addition, there are fringe benefits. Chapter 6 assembles the data which exist on fringe benefits classified by educational level.

Once the above methodological and special topics have been discussed, we examine in chapter 7 some aggregate relationships between earnings and education in O.E.C.D. countries. Two kinds of patterns are presented; firstly, cross-sectional between countries and, secondly, over time within countries. In the last chapter (8) we attempt to summarise the state of our knowledge in this field, and suggest some areas that should receive increased research attention.

The Appendix to chapter 7 gives more detailed tabulations of earnings by education and documents the sources of such data in a number of countries. Lastly, this volume contains a large bibliography not only on the sources of earnings data by country, but also classified by each of the special topics.

Chapter 2

WHY EXAMINE EARNINGS DIFFERENTIALS?

As mentioned earlier the theme of this volume is the relationship between earnings and education. In this chapter we give the rationale for examining this particular relationship.

The study of the wage structure is a classic subject in labour economics. Traditionally, interest has been concentrated on comparisons of earnings in different industries, regions and occupations as well as variations due to sex and race differences. Once an earnings differential is established it becomes an "allocative signal". Higher earnings in one region relative to another may induce migration of lower-paid labour, unless they are simply a compensation for higher living costs in that region.

Interest in wage variations by level of education is fairly new[1] but is equally interesting analytically. Below we describe some possible uses of data on earnings differentials by level of education.

Efficiency

One of the first uses of earnings differentials by educational level was in studies of the efficiency with which resources are allocated in education. This is done by comparing benefits and costs of given levels of education.

Let us take the case of higher education as an example. If graduates earn $3,000 per year on average more than non-graduates this can be accepted as a first approximation of the extra annual social product of one higher education graduate to the economy. This figure could then (after appropriate discount and cumulation over the individual's lifetime) be compared to the average cost of providing a university place. The resulting net present value, or cost-benefit ratio, or rate of return to investment in higher education can then be compared to the profitability of investment at the secondary level or even to the yield on non-educational investment projects. If the return to higher education is superior to that on secondary education, the relative emphasis in the allocation of the educational budget should be placed on higher education. Similarly, if one can arrive at a single profitability measure of investment in education as a whole, this could be compared to the return to physical capital. In this case, social policy could take the form of allocating more or less to the education sector relative to the rest of the economy. In other words, there exists two basic kinds of efficiency considerations in education. Firstly, an allocation decision between education and the rest of the economy, and secondly, an allocation decision within education itself. The latter could take the form of choice among different specialities within, say, higher education, or even between vocational and general secondary education.[1]

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[1] For some earlier attempts see Fisher (1932) and Gorseline (1932).

One important distinction we should draw at this point is between private and social efficiency measures. A private efficiency measure is calculated from the individual's point of view, namely earnings are after tax and direct costs include only what the individual pays out of his pocket. A social efficiency measure is calculated from the societal point of view, namely earnings are gross of tax and costs include the full resources devoted to education. To the extent that education is usually subsidised by the State, divergences arise between the two efficiency measures, the private returns being higher than the social. Of course, for formulation of social policy one should be based on social efficiency measures. But private returns are also helpful in studying the behaviour of individuals in their choice of, for example, specialities within higher education.

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[1] For a review of the existing profitability estimates in education around the world, see Psacharopoulos (1973).

Substitution

This is an analysis closely related to the efficiency aspect discussed earlier. Assume that the production relationships in the economy are very rigid and there exists only a unique mix of educated labour (say, one university graduate, and two secondary school graduates), that can produce $1,000 worth of manufacturing products. We will describe this case as a zero substitution case; there is no room for altering the combination of educated labour in order to produce the same amount of output. Assume also that the ratio of the existing secondary to higher education graduates in the economy is 2:1 and that the level of economic activity is such so that there is no surplus or shortage of labour of any kind. The quantity balance described in the first chapter is observed.

Now assume we wish to expand output in this hypothetical economy and that the relative earnings of university to secondary school graduates are, say, in the ratio of 1.3 to 1. The value of an extra higher education graduate (equal to 130 per cent of the earnings of a secondary school graduate) does not enter into the policy maker's consideration operating in this rigid world. Higher education and secondary education should expand at the ratio of 2:1, if output is to expand. If labour supply is not infinitely elastic, a shortage or surplus of educated persons will result.

But if the production relationships are not rigid and substitution can take place then one should plan the output of the different levels of education according to the costs and benefits associated with them. The earnings differential between graduates and non-graduates should now be taken into account and the higher education activity carried to the point where the yield to it equals the yield of alternative investments. Note that in this case a ratio of other than 2:1 of secondary to higher education graduates might result. But there would not be unemployment or shortage of graduates of any kind as the economy is assumed to be flexible and whatever relative quantities of educated labour are produced will be absorbed.

In fact, availability of relative quantities of educated labour and their relative earnings can tell us whether the economy is flexible or not. For flexibility means relative wages responding to relative quantities of labour. For example, the way all available labour of a given kind is absorbed, is through movements of its remuneration. If too much of one kind of labour is available, its wage falls relative to other kinds of labour an vice versa. To put it in other words, economies in which relative wages move as a function of relative quantities of labour are "flexible" for our purposes.

It is also in this sense that statistics on earnings by educational level complement traditional statistics on relative quantities of educated labour as the degree of substitution in production can be assessed.[1] Once the degree of substitution is assessed one can then employ the appropriate methodology for educational planning, for if the degree of substitution is low, then the relative quantities of labour are important and one should plan according to the manpower requirements approach. If, on the other hand, the degree of substitution is high one should plan the education sector according to the social efficiency measure described earlier.[2]

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[1] As an example of such exercise, see Bowles (1969).

[2] For an elaboration on this topic see Blaug (1967).

Equity

It is a statistical fact that more educated persons earn more than less educated persons. Therefore, education has something to do with the size distribution of income in our society. However, the way education influences income distribution is not very clear. For it is not only the relative earnings that matter, but the numbers of people who receive the different educational qualifications as well. For example, provision of higher education to a small segment of the population might worsen income distribution, whereas raising the minimum schooling age (and thus affecting a larger number of individuals) might make income distribution more equal.

There exist econometric techniques which permit the study of the variance in incomes in relation to the variance of the level of schooling and other characteristics of the individual.[1] The result of work in this area is as yet very inconclusive. In a recent study Jencks (1972) claims that schooling has very little to do with income distribution in America.

Jencks' results are discussed and criticised later in this book (chapter 4). It is sufficient to state to this point that data on earnings by education are useful in analysing the role of schools in income distribution.

Labour quality and growth accounting

One of the early uses of earnings by educational level was to provide weights for different categories of labour in order to derive aggregate labour inputs either for growth accounting purposes or for assessing over time changes in the quality of labour.[2]

Note that disaggregation of labour by educational category is not enough. This refers to the quantity aspect discussed earlier. The quantity breakdown of labour must be linked to a price measure for assessing the true flow service of labour. A typical example of this approach is Denison's analysis discussed in chapter 3 below.

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[1] e.g. see Mincer (1974) and Becker (1971).

[2] For a good discussion and empirical construction of an aggregate labour input see Dougherty (1972).

Note also that the use of the number of years of schooling as weights is deficient. The reason is that years of schooling completed is just another quantity measure. Any quality differences either between countries or levels of schooling within countries are masked. An earnings weighting scheme, however, takes into account quality differences. As an example consider the following three schemes for weighting a set of disaggregated labour inputs by education (1, 2 and 3 subscripts) into a single labour aggregate:

(a) $L = L_1 + L_2 + L_3$

This is the naive unweighted version and is ruled out as giving equal weight to all inputs.

(b) $L = L_1 S_1 + L_2 S_2 + L_3 S_3$

This is the years of schooling weighting scheme which fails to take into account quality variations.

(c) $L = L_1 Y_1 + L_2 Y_3 + L_3 Y_3$

This is the earnings weighting scheme which is judged as being superior to (a) and (b) above. Yet this last scheme is far from perfect. For there exists a large considerable variance in productivity within educational levels. Nevertheless, earnings by education data contribute significantly towards the construction of a true index of labour services in the economy.

Unemployment and job search

The educational system affects people's propensity towards unemployment. Casual observation suggests that more educated persons are less prone to experience unemployment than less educated persons. However, this is not universally true. Recent evidence in less developed countries suggests that it is secondary school graduates who experience the highest level of unemployment.[1] Furthermore, graduates in many advanced countries are recently experiencing unemployment.

The wage structure is crucial in studying the question of unemployment. At the lower educational spectrum minimum wages might be responsible for it. At the higher spectrum graduates might search for a long time before accepting a job, so as not to commit themselves to a lower escalator.[2]

Supply response

As mentioned earlier, the profitability of investment in education can be seen from two points of view. One is the point of view of society as a whole, and the relevant measure is used for allocating resources to education. The other is the private point of view and the relevant measure can be used by the individual as a signal for demanding more or less education of a given kind. Research has recently shown that, at least in developed countries, students are highly sensitive to relative wages (e.g. see Freeman 1971). Therefore, data on earnings by education are useful in anticipating the so-called "social demand" for education. Alternatively, an incomes policy might be used to shape the desired demand for education by individuals as to implement the targets of an educational plan.

Costs of education

Data on earnings by education are also useful in assessing the true costs of education. The reason is that the earnings of, say, secondary school graduates represent the indirect costs (or foregone earnings) of higher education graduates. Because of the lack of earnings data many educational plans to date have been based on a partial cost picture of the true resources devoted to education.

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[1] At least when the latter is defined according to conventional definitions. See Turnham and Jaeger (1971) and I.L.O. (1972) report on World Employment Programme mission to Kenya.

[2] See Blaug et al. (1969) and Metcalf (1973).

The recent availability of earnings by education data has corrected the above distorted picture with the result that new investment priorities have emerged.

Screening

Earnings by education data can also be helpful in testing the so-called screening (or certification, or filter) hypothesis. According to the extreme version of this hypothesis schooling does not have a productive role per se. All it does is select individuals according to their ability for filling the higher paid jobs. Since this selection could have taken place by less expensive tests (than, say, a four-year university cycle), resources are wasted.

The early "test" of this hypothesis consisted in observing the over time change in the educational attainment of labour performing a given job (e.g. Berg 1971). This was contrasted to some normative educational requirements for that kind of job. For example, assume that the typist's functions requires 12 years of schooling. If in a 10 year period typists are observed to have an educational attainment of 16 years of schooling, this is judged as educational upgrading (or inflation).The extra 4 years of schooling were not really required for the typist to perform her functions and therefore (so the screening argument goes) they represent a sort of social waste. Although they were privately profitable for the typist to find her job (as employers look at certificates as a proxy for ability), they were not socially profitable (in the sense that the typist selection could have taken place by means of a less expensive test).

The availability of age-earnings profiles by educational level has permitted a more rigorous testing of the screening hypothesis. For example, one prediction of the filter hypothesis is that the returns to completed educational levels should be higher than the returns to dropouts of the same level. The reason for this prediction is that employers would be willing to pay a (mistakenly) high premium to certificates alone. But, this does not seem to be the case when one constrasts the returns to completed levels versus the returns to dropouts.[1] However, it should be noted that the screening hypothesis is still being debated in the literature and that earnings by education data constitute the necessary raw material for testing it.

How good are crude earnings differentials?

The above are but a few analyses one can conduct by using earnings data by education. However, one question that has often been raised in connection with such analyses is: how well do earnings differentials measure the economic value of education?

The economic value of education is generally assumed to be due to higher productivity of more educated persons in the labour force. In view of the difficulties in measuring productivity, the practice has been to approximate it by the earnings of labour classified by educational level. However, it is only in an ideal, perfectly competitive economy that observed market earnings would correspond to marginal labour productivity. If market distortions prevent a wage equilibrating mechanism from operating then crude earnings statistics would be of little use for the analyses presented above (unless distortions are proportionate or uncorrelated with marginal products).

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[1] For empirical tests of the screening hypothesis see Layard and Psacharopoulos (1974).

In the following four chapters we look deeper into the concept of "earnings differential" by taking into account common criticism of it. For example, we examine to what extent an earnings differential is due to differential education rather than differential ability. The answer to this question would be important in order to adjust crude earnings differentials for differential ability.

In chapter 4 we look at the effect of the quality of schooling on earnings differentials. Most of the analysis in the economics of education has been conducted by using the quantity of schooling as the instrumental variable. We now ask the question whether, and how much, schooling quality matters.

It has been often argued that earnings differentials might reflect the monopoly power of organised labour rather than differences in educational attainment. In chapter 5 we ask the question as to what extent this allegation is true.

Another way in which earnings differentials (as commonly used) might not give an accurate picture of real productivity differences, is to the extent that fringe labour benefits are neglected. In chapter 6 we attempt to assess the importance of neglecting the fringe benefits component in wage statistics.

The analysis in the following four chapters proceeds in terms of a straightforward review of the literature. However, a number of methodological points are discussed when they naturally occur in connection with the different works under review.

One methodological point that should be made explicit at the outset is that we have concentrated on the analytical tool of the "earnings function". This relates the earnings of one individual to different characteristics of the same individual like his age, ability, quality of school he attended, etc.[1]

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[1] The concept of the earnings function is explained in detail in the following chapter.

But some ability measures (e.g. the individual's verbal score) can be related to a variety of inputs (like the teacher/student ratio, his socioeconomic background etc.) that determine the level of measured ability. This last relationship is known in the literature as an "educational production function" and is outside the scope of this volume.[1] Since our main concern here is the study of earnings we limited ourselves to the direct route (namely, how does ability relate to earnings) rather than the indirect one (namely, how do different school inputs affect student achievement which in turn affects earnings later in life).

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[1] For typical examples in the vast literature on educational production functions see Bowles (1970) and Hanushek (1971).

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Chapter 3

ABILITY ADJUSTMENTS

Ever since the establishment of human capital as a separate field in economics the question remains of how much of the observed earnings differential between various levels of education is due to the extra education received.

Assume that a typical higher education graduate earns $Y_h = \$12,000$ per year and a typical secondary school graduate earns $Y_s = \$9,000$ per year. Are we allowed to conclude that the $\$3,000$ differential (ΔY) is due to higher education? Obviously not. The typical higher education graduate may differ in many respects other than education from the typical secondary school graduate. For example, if university graduates are on the average more clever than secondary school graduates at least part of the earnings differential ($\Delta Y = Y_h - Y_s$) must be attributed to native intelligence rather than education.

Differential intelligence or innate ability is but one factor in which people with more education may differ from people with less education. One could add differential student motivation. Or even different educational background of parents, the more educated ones pushing their children to acquire at least as much education as themselves. Or differential income of parents that permits the finance of lengthier studies. Or simply different family environment conducive to study. And of course one could go on adding similar factors which differentiate given educational attainment groups in our society.

The literature on the economics of education recognised very early these differences in attributes (other than education) between people with different amounts of schooling. Therefore, the observed earnings differentials were lowered by an adjustment factor in order to arrive at a net differential, now strictly due to education.

This adjustment factor has been known in the literature as the alpha coefficient (α) and shows the proportion of earnings differentials attributed to education alone. The quantity ($1-\alpha$) shows the proportion of earnings differentials due to factors other than education.

In what follows we shall treat earnings differentials by level of education as a constant throughout the working life of an individual. This is not only a necessary simplification for illustrative purposes, but it also refers to much of the empirical material reviewed later in this book. It should be noted, however, that earnings differ not only by educational level, but by age and occupation as well. The effects of schooling on earnings are closely linked (if not identical) to differential career paths (Bowman 1973).

Bearing in mind the above qualification the net earnings differential ($\Delta Y'$) is defined as

$$\Delta Y' = \alpha \Delta Y = \alpha(Y_h - Y_s)$$

Since α assumes values less than unity the adjusted differential is of course lower than the crude differential.

Although α is a mnemonic for "ability" it should be stressed that the alpha coefficient, as used in the literature, is a catch-all factor for everything that causes earnings to differ, other than education. Therefore, the alpha coefficient usually includes adjustments for ability, socio-economic background and so on.

Alpha adjustments have been crucial in mainly two streams of analysis in the economics of education: rate of return computations and growth accounting.

The crude rate of return to investment in, say, higher education is found by the following formula, where C_h stands for direct costs:

$$r_h = \frac{Y_h - Y_s}{C_h + Y_s}$$

The correction would involve multiplying the numerator of this expression by α and therefore lowering the rate of return.

In growth accounting the contribution of education is found by correcting the numbers of people employed over time by a labour quality index. The latter is based on marginal productivity weights. Once again, the α coefficient is used to reduce the spread of this weighting factor due to attributes other than education.

The purpose of this chapter is to review evidence on the empirical value of α, with particular emphasis on the "ability" component. Firstly, we analyse the methodology for making estimates of α. Secondly, a critical review is presented of empirical studies which either contain an estimate of α or from which a value of α can be deduced. The last section of this chapter attempts a synthesis of the surveyed results.

Methodology

There have been two major approaches in estimating empirical values of alpha: (a) by means of tabulation studies, and (b) by means of regression analysis. The latter category could be subdivided into three sets:

(i) using individual data,
(ii) using grouped data, and
(iii) using matched data.

By "individual data" we mean that the different observations that enter into the regression refer to individuals. "Grouped data" means that averages over a group of individuals enter into the regression. Finally, "matched data" implies not only grouping of individuals, but also that the different observations are taken from different samples which the investigator has matched in some way.

The majority of studies reviewed in this chapter have used methods (a) and (b)i. As it will be argued later, method (a) is statistically primitive and refers to early alpha calculations. Method (b)i is more recent and more respectable. The following sections present illustrative examples of the two major techniques.

Tabulation method

Assume that the following cross-tabulations are available from a sample of earnings by level of education and IQ.

Educational level	Mean Earnings	Mean IQ
Secondary	$9,000	90
Higher	12,000	110

The earnings of higher education graduates by IQ are distributed as follows:

Groups of individuals	Mean Earnings	Mean IQ
A	$11,000	90
B	12,000	110
C	13,000	130
Overall mean	12,000	110

From the first tabulation we get that the gross differential is $\Delta Y = 12{,}000 - 9{,}000 = \$3{,}000$. The question now is: how much would a higher education graduate earn if he were of an equal ability of a secondary school graduate? In order to answer this question the second tabulation can be utilised. If secondary school graduates have a typical IQ of 90, then the $11,000 can be taken as the earnings of a college graduate standardised for ability. In this case the adjusted differential would have been $\Delta Y' = 11{,}000 - 9{,}000 = \$2{,}000$ and the value of alpha equal to .67, as

$$= \frac{\Delta Y'}{\Delta Y} = \frac{2{,}000}{3{,}000} = .67$$

The methodology of tabulation studies consists in obtaining an estimate of earnings of a graduate of a given educational level but with a different level of ability or factors other than education (Y'). Then the alpha is found by the following formula

$$\alpha = \frac{Y'_h - Y_s}{Y_h - Y_s} = \frac{\text{Net differential}}{\text{Gross differential}}$$

The tabulation method described above has many limitations:

(a) One is never sure of the statistical significance of the results. Statements about alpha are based on differences between average quantities and the statistical significance of these averages cannot be established. When working with averages, the variance of the individual observations disappear and therefore no rigorous hypothesis testing can take place.

(b) When more than one adjustment is needed (for example, not only for ability, but for motivation, parental status, etc.) the sample should be subdivided into smaller and smaller groups in order to acquire the necessary cross-tabulations. Tabulation studies have never used large samples and this procedure quickly leads to empty table cells. What is even worse is that inferences about the population as a whole are made from cells containing very few observations. (e.g. Denison 1964).

(c) When earnings standardisation takes place for more than one effect (e.g. for ability, parental status, etc.) tabulation studies cannot take into account the joint effect of all the variables one wants to control for. Isolated influences of single variables can possibly be discerned through tabulation studies. But the joint effect of all variables together might not be additive due to the fact that all earnings determining factors are closely related to each other.

(d) The data in the different cross-tabulations are usually obtained from different sources and therefore refer to different populations. For example, the gross earnings differential is usually taken from Census data whereas the adjusted differential is based on a particular sample in a given city or even firm and therefore can be hardly generalised to the population as a whole. (e.g. see Weisbrod and Karpoff 1968).

The only possible advantage of tabulation studies is that one could detect interaction effects not caught by an "interaction term" in usual regression analysis. The reason is that tabulation studies do not impose linearity of any kind, as least square regressions usually do.

Regression analysis

Regression analysis provides an alternative to tabulation studies in standardising earnings for effects other than education. This kind of analysis, however, is more data demanding than tabulation studies. Individual observations are required on earnings, IQ, age and all other factors one wants to control for. Such individual observations have not been available until recently and this explains the early boom of tabulation studies.

Regression analysis refers to the statistical technique used. However, the standardisation procedure by regression analysis is more commonly known as "fitting earnings functions". An earnings function relates the earnings of an individual (Y) to a battery of characteristics of the same individual, like his age, years of schooling (S), ability (A), father's occupation (F) and so on: $Y = f(S, A, F, Age, \ldots\ldots)$

Once such individual data are available the function can be specified (e.g. in a linear or a log-linear form), fitted and thus provide a quantitative relationship between earnings and a host of other variables associated with earnings. This empirical relationship can then be used to isolate the effect of single variables on earnings (like education) controlling for the effect of other variables (like ability).

Let us consider the following example. Assume that the earnings function is fitted using only age and schooling as independent variables, the result being:

$$Y = -1137 + 60\ \text{Age} + 667\ S \qquad (1)$$

where S is measured in years of schooling completed. Equation (1) says that the partial effect of education on earnings, controlling for age, is $667. Namely, one extra year of schooling generates to the typical individual $667 extra earnings per year.

If the function is now fitted including the ability variable A (measured in IQ points), the result may look as follows:[1]

$$Y = 100 + 50\ \text{Age} + 500\ S + 10\ A \qquad (2)$$

The coefficient of schooling in the regression was reduced from $667 to $500. The reason is that since ability affects earnings its inclusion in the regression has "stolen" some of the effect of education on earnings. To put it in other words, the $500 effect of education on earnings is standardised for ability, whereas the $667 was not.

The implicit alpha coefficient in this particular example is

$$\alpha = \frac{500}{667} = .75 \ .$$

To put it in more general terms, an α coefficient can be computed from an earnings function in the following way. As a first step let the function be fitted without the variables one wants to control for, e.g.

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[1] This hypothetical example was constructed so as to correspond to the following sample means: $\bar{Y}$ = $8,600, $\overline{\text{Age}}$ = 40 years, $\bar{A}$ = 100 IQ points and $\bar{S}$ = 11 years.

$$Y = a + b\ S.$$

As a second step, one adds the variables he wants to standardise for and observe the difference in the regression coefficient of schooling, e.g.

$$Y = a' + b'\ S + c\ (\text{Other variables})$$

Then the alpha coefficient can be found as the ratio of the two schooling coefficients, i.e.

$$\alpha = \frac{b'}{b}$$

It should be noted at this point that when an earnings function is available the estimation of alpha might be superfluous. The reason one wants the alpha statistic is to adjust earnings differentials and this is exactly what an earnings function does. This is illustrated below.

Assume that the problem is to find the net earnings differential between higher and secondary education graduates, and that equation (2) is available. Then, by setting ability and age at their mean values (100 and 40, respectively) and S equal to 12 years and 16 years in succession (to correspond to secondary and higher education, respectively), the following adjusted earnings are obtained

$$Y_h = 100 + 50(40) + 500\ (16) + 10(100) = \$11,100$$

$$Y_s = 100 + 50(40) + 500\ (12) + 10(100) = \quad 9,100$$

Therefore, the net differential is 11,100 - 9,100 = 2,000 = $\Delta Y'$. Note that if regression (1) were used (that is, without standardisation) the gross differential would have been ΔY = 2,668. Hence, the implicit alpha from this procedure is

$$\alpha = \frac{\Delta Y'}{\Delta Y} = \frac{2,000}{2,668} = .75$$

Although estimation of alpha is not necessary when regression results are available, in this chapter we do estimate such alphas. The reason is simply that our purpose is to try to answer the question of how much of the earnings differential is due to education relative to ability and other factors. Moreover, alphas estimated through regression analysis could be used to check the adjustment factors resulting from earlier tabulation studies. And of course if one manages to arrive at a generalised value of alpha, one could apply it (heroically) to cases where regression results are not available.

Earnings functions do not suffer from the above mentioned defects regarding tabulation studies. In particular, the statistical significance of the results can be established by observing the standard error of the regression coefficients. Moreover, interaction effects of more than one variable can be studied by introducing multiplicative terms in the regression (e.g. Hause 1972).

The procedure described above refers to category (b)i, above. In some instances, where individual data are not available it is possible to run regressions on grouped data. For example, if a number of observations is available on the average earnings by the average years of school completed and by the average IQ, it is still possible to run a regression with these averages. (e.g. Griliches 1970). However, the disadvantage of this procedure is that most of the variation of the individual variables is removed through averaging, before the data enter in the regression.

The third variant of regression analysis is the "matched data" technique. This technique not only uses averages as described above but also the different observations are obtained from different populations. For example, the the earnings data may come from the Census while the ability data may come from a special survey. (e.g. Conlisk 1971).

Of course this technique suffers from the defects mentioned in connection with the tabulation studies (in- complete matching of populations) and the grouped data studies (removal of variation through averaging).

Further methodological points

Which ability? In the above we have used the term "ability" in a rather loose fashion. We now consider what measure of ability should enter in an earnings function.

Researchers have traditionally used the following measures for ability:

- IQ
- Class rank
- School grades
- Military service qualification test scores.

The ability measure should have the following attributes:

(a) It should relate to the ability to earn income, and

(b) It should not be influenced by education itself.

All ability measures mentioned in the previous paragraph are defective in one or both of ability attributes. The IQ measure depends on when it has been recorded. Psychologists claim that if it has been measured after the age of 6, it is a less than perfect measure of innate ability as it would have been influenced by the family environment and education. Therefore, what appears as a return to ability may in fact be a return to education itself. Class rank and school grades are notoriously known as not correlating very well with later success in life and earnings in particular. Of course one could use earnings itself as a measure of ability (Becker 1964, p.61) but this cannot carry us very far analytically. Finally, military test scores are recorded too late in the individual's life to reflect innate ability. (Griliches and Mason 1972 is an exception in this respect as they related the military test score to schooling obtained after military service).

In short, the ability measures used concentrated on "academic" rather than "economic" ability, let alone creativity. T.W. Schultz (1974) notes that a person's ability can be decomposed into ability to learn, ability to work, ability to consume and ability to cope with changes in his environment. He calls the latter "ability to deal with economic disequilibria". Although this ability concept might be more useful for our purposes, the question is how one measures it? He notes that so far no tests have been designed to predict economic performance.

Differential alphas? In the early days of earnings adjustments the convenient simplification was made that alpha had the same value between all educational levels. The net differential between primary school and illiterates, and between higher and secondary school graduates was found by applying a unique value of α to both differentials (e.g. Denison's famous .6). Later, however, this proved to be an over-simplification. There is no reason why factors other than education would act in exactly the same way as between lower and between higher levels of education.

To illustrate this point let us follow a typical individual through the school system and consider only two components of alpha: ability and socioeconomic background. Although both factors are positively correlated with education and earnings, their relative importance might differ according to the level of schooling.

For a child to graduate from primary school, ability may not count as much as social background. If, for example, the child comes from a poor family environment he may never reach the higher educational levels because of the importance of his foregone earnings or simply because of inadequate coaching at home. Once, however, the child has overcome this barrier and reached secondary school, the social background may not be as important as differential ability in order to obtain a place at the university.

Empirical evidence reviewed below shows that the net outcome of these two adjustments (ability and socioeconomic background) is not conclusive as to determine differential alpha values for different levels of schooling.

Another point refers to the value of alpha across countries. In the early days of earnings adjustments Denison's .6 value for the U.S. was used for other countries as well. But of course there is no reason for the proportion of the earnings differential explained by education to be the same in India and in the United States. For example Blaug (1965) pointed out that alpha should be higher in less developed countries, as in those countries educated people are scarce and therefore command a premium.[1]

A review of the evidence

After the above methodological remarks we now turn to examine the empirical values of alpha. The presentation will follow a mix of chronological, author and methodology order. Therefore, we start with the early tabulation studies and Denison's analyses (past and present) and finish with the matched data technique.

For each study we will try to list, whenever possible, the methodology used, the sample size and reference, and the value of alpha or alphas. With respect to the latter we will try to list, whenever possible, where the adjustment refers to (i.e., to ability only, or to ability and other factors?), and to what educational level the coefficient refers to (i.e., is it the same for all levels, or does it refer to higher versus secondary education graduates only?). Whenever appropriate we will also try to list particular methodological points of the study and discuss its strong or weak points.

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[1] For a discussion of differential alphas across countries see also Carnoy (1971).

A birds-eye view of alpha adjustments is given below:

1962 Denison assumed that $\alpha = .6$. This adjustment included factors other than ability and is universal for all educational levels.

1962 The first earnings functions including ability as an independent variable were run by Hunt on the one hand and by Morgan et.al. on the other. Their results revealed that ability was not an important determinant of earnings.

1963 Morgan and David published results in such a form that an alpha could be computed. This ranged from a low of .40 in the case of primary schools to a high of 1.00 for graduate study.

1964 Denison defended his 1962 $\alpha = .60$ assumption by using cross-tabulations from the Wolfle and Smith survey. The alpha coefficient turned out to be equal to .67 . But in view of the similarity to .60 he did not change his original assumption. Denison neglected the work of Hunt and Morgan et.al.

1964 Becker reviews the ability adjustments from Wolfle and Smith, Morgan and David, and Hunt. Moreover he elaborated some new evidence on the earnings of employees of the Bell Telephone Company and on a previous study on the earnings of brothers by Gorseline.

1965 Blaug wrote the first explicit discussion on the alpha coefficient. But he attempted no estimates of alpha.

Thereafter earnings functions flourished and so does the mix of results presented below.

Denison

Denison (1962) wanted to find the contribution of different factors to the economic growth of the United States. For this purpose he had to adjust the crude labour headcount for quality. As mentioned in the previous chapter, this adjustment requires a set of weights in order to combine individuals with different amounts of schooling. The relative earnings of labour classified by level of schooling provided such weights (as a proxy for labour productivity). However, he had to narrow the observed earnings differentials in order to adjust for factors other than ability.

Later, while presenting again his results on the sources of economic growth in the United States at an O.E.C.D. Conference (Denison 1964) he included an appendix in support of his earlier .60 assumption. The evidence on alpha was based on cross-tabulations of salary, education, rank in high school class, IQ and father's socioeconomic status supplied by Wolfle and Smith (1956). The sample consisted of 2,889 high school graduates between 1935 and 1938 in Illinois, Minnesota and New York. Their salary was recorded 20 years later. Using the tabulation method described above, Denison came up with an empirical value of alpha equal to .67 . And in view of the similarity between .60 and .67 he did not alter his original figure.

In a later expansion of his work to other countries (Denison 1967) he used the same alpha = .60 adjustment factor.

Denison's analysis until 1967 suffered from the following weaknesses:

(a) The tabulation method was used in order to establish alpha. As mentioned earlier this is a very crude technique, for one is never sure of the statistical significance of the results and the interaction between different variables.

(b) The Wolfle and Smith sample refers only to secondary school graduates, college dropouts and college graduates. Of course it is not valid to project a value of alpha based on this evidence to the lower levels of education.

(c) The Wolfle and Smith sample refers to superior high school graduates. The Illinois and Minnesota graduates were in the top 60 per cent of their class. The New York graduates were in the top 20 per cent. Therefore, a value of alpha based on this evidence cannot be generalised to the US labour force as a whole.

(d) The sample size is rather small to be generalised to the U.S. as a whole. And of course it is not valid to apply the same value of alpha to other countries.

(e) The alpha coefficient in Denison's work is a catch-all factor for ability, socioeconomic background and everything that may determine earnings other than education. Of course this aggregation is not very helpful analytically.

Let us now jump the chronological sequence in order to concentrate on the same author. Denison (1974) reconsiders the Wolfle and Smith data along with additional evidence from Rogers (1969), Weisbrod and Karpoff (1968) and Cutright (unpublished) in order to estimate new education weights. The alpha coefficients implicit in Denison's new work are shown in Table 3.1, below. It should be noted that the alpha coefficient now declines as the educational level rises. However, when the alphas between completed educational levels are considered, they are all equal to .88 .

This recent Denison study corrects some of the deficiencies mentioned above regarding his earlier work. In particular he considers explicitly evidence (from Rogers and Cutright) on the value of alpha for lower educational levels.

Table 3.1

Gross and adjusted earnings differentials for ability and other factors

Educational level	Index of gross earnings[a] (8 years of education = 100) Y	Gross increment ΔY		Index of net earnings Y'	Net[b] increment ΔY'		Alpha $\frac{\Delta Y'}{\Delta Y}$	
(1)	(2)	(3)		(4)	(5)		(6)	
None	71.6			75				
			14.9			14	.94	
Elem.1-4	86.5			89				
		28.4	9.0		25	8	.89	.88
5-7	95.5			97				
			4.5			3	.67	
8	100.0			100				
			12.6			11	.87	
Sec.1-3	112.6	27.3		111	24			.88
			14.7			13	.88	
4	127.3			124				
			26.6			23	.86	
Coll.1-3	153.9	74.0		147	65			.88
			47.4			42	.89	
4	201.3			189				
			62.9			30	.48	
5	264.2			2.9				

Source: Based on Denison (1974), Tables 1.4 and 1.14.

a. 1959 earnings of males already adjusted for farm/non-farm attachment, colour and region.

b. Adjusted for ability and socioeconomic background

Underlined figures refer to completed educational levels.

Becker

Whereas Denison's concern was alpha adjustments for growth accounting, Becker (1964) wanted to narrow the observed earnings differentials for estimating a rate of return to investment in education, net of ability and other factors. For this purpose he surveyed five existing studies at the time:

(a) The Bell Telephone Company data,

(b) The Wolfle and Smith survey,

(c) The Morgan and David study,

(d) The Gorseline evidence on the earnings of brothers, and

(e) The Hunt study.

A study on the earnings of college graduates employed by the Bell Company yielded the following result:

Rank in college	Index of earnings 15 years after graduation
Top two-fifths	120
Bottom two-fifths	100

In other words employees who were in the top of their class were earning 20 per cent more than employees in the bottom of the class.

By using the tabulation method described earlier, Becker found an alpha coefficient equal to .80 . This applied to the differential between college and high school graduates and the adjustment reference is for class rank only. The eventual effect of this adjustment was to reduce the rate of return to college graduates by about 12 per cent.

Using the Wolfle and Smith data described earlier and the tabulation method, Becker found an alpha between high school and college equal to .80 when class rank was used as a proxy for ability. When IQ was used as a proxy for ability, the alpha ranged between .80 and .85 . The combined effect of the ability plus background adjustment (as measured by fathef's occupation, education and earnings) was an alpha equal to .65 . This figure is not very different from Denison's as they both used the same body of data.

Becker used the Morgan and David (1963) results to compute values of alpha. (This is one of the earliest earnings functions and it is reviewed below in this paper). Becker's alphas from this study (averages for the ages 18-74) were .52 for the secondary-primary school differential and .74 for the college-secondary differential. These adjustment factors include not only ability but socioeconomic background as well.

Becker utilised the data found in an early study by Gorseline (1932) to compute alphas between different educational levels. Since the Gorseline data on earnings referred to brothers, the alphas contain also a standardisation for socioeconomic background. These alphas were equal to .73 and .81 between secondary and primary school, and between college and secondary school, respectively. (The alphas corrected for under-reporting of earnings were about ten percentage points lower).

Becker just hints at the study by Hunt (1963). This study is reviewed below.

Becker's attempt to estimate alpha has been more exhaustive than Denison's in that the former has examined all the available evidence at the time. However, the studies on which his results are based had little generalisation value. Consider the following example.

On the basis of the following tabulation Becker concluded that the ability adjustment is more important at the lower educational levels.

Table 3.2

IQ by educational level

Educational level	IQ	
(1)	(2)	(3)
7-8 years	84.9	
High school dropout	98.0	
High school graduate[a]	112.0	
High school graduate[a]		106.8
College dropout		106.2
College graduate		120.5

Source: Col.2, Becker (1964), p.125

Col.3, Becker (1964), p.80

[a] The difference in the two IQ scores is due to the fact that the two columns are taken from different studies.

In other words, Becker established a differential alpha for ability only, that would rise with the level of education. But as seen below, Hause (1972) using a more representative sample and more sophisticated statistical techniques came to the opposite conclusion. Namely, the ability adjustment was found to be more important at the higher levels of education.

Early regression studies

Morgan, David, Cohen and Brazer (1962) used data on the 1959 earnings of 3,000 heads of households and a battery of explanatory variables in order to run an earnings function in the United States. Two measures of ability were used: (a) rank and progress in school, and (b) the interviewer's assessment of the individual's ability to communicate. Table 3.3, below shows the relative importance of selected variables in determining earnings.

Table 3.3

Relative importance of selected variables in determining earnings

Characteristics of head of household	Relative importance (beta coefficient) a.
Education and age	.234
Sex	.220
Occupation	.205
Attitude towards hard work	.067
Race	.066
Ability to communicate	.061
Physical condition	.056
Rank and Progress in school	.027

Source: Morgan et.al. (1962), p.48

a. The beta coefficient is a standardised ordinary regression coefficient for the units in which the variables are expressed. Therefore, its size shows the relative importance of different independent variables in explaining the dependant.

$$\text{Beta} = \text{Regression coeff.} \times \frac{\text{Stand.dev.of indep.variable}}{\text{Stand.dev.of dep.variable}} .$$

Therefore, this study has shown that ability is not as important as education in determining earnings. However, it is impossible from the published results to distinguish the effect of age relative to the effect of education and therefore arrive at estimates for alpha.

Before we present the caveats associated with this study, let us examine another presentation of the same results.

Morgan and David (1963) have later published gross and adjusted age-earnings profiles for different educational levels. It was from these profiles that Becker estimated the alphas reported earlier.

Concentrating at the age group 35-44 the following implied alphas can be computed:

Table 3.4

The proportion of earnings due to education, by educational level

Educational level	Alpha
1-8 grades	
	.40
12 grades	
	.88
B.A.	
	1.00
Graduate study	

Source: Based on Morgan and David (1963), p.433.

As shown in this table, the alpha rises by educational level. In fact, the unitary alpha between a first degree and graduate study means that no adjustment of the earnings differential is needed between these two educational levels. However, one should be cautious with respect to this result.

Although Morgan and David's study is superior on many counts relative to the tabulation studies examined earlier, it suffers from a major defect.

It has overstandardised earnings and therefore the values of alpha reported above should be treated as lower limits. The alphas reported above are standardised for occupation. However, occupation is one factor one should not standardise for, as it is the vehicle through which the effect of education on earnings takes place. To put it in Becker's terms

> " ... when standardising ... one must be careful not to go too far. For education has little direct effect on earnings; it operates primarily indirectly through the effect on knowledge and skills. Consequently, by standardising for enough measures for knowledge and skill, such as occupation or ability to communicate, one can eliminate the entire true effect of education on earnings". (Becker 1964, p.86).

But it should be noted that even in the presence of an adjustment for occupation, the alphas assume very high values between the higher educational levels.

Hunt (1963) used a 1947 survey of Time magazine on the incomes of college graduates to run an earnings function. The total number of observations was 2,625. Hunt used a host of explanatory variables like ability, years of graduate study, parents college attendance, occupation, region and so on. The measure of ability was the test score in college, adjusted for variations in the grading standards among different fields within the same college.

The way Hunt's results are presented make it impossible to estimate a value of alpha. However, the rate of return to college education, when adjusted for all the above variables was reduced by about 50 per cent.

Hunt's study suffers from a rather small sample size, used income rather than earnings, used occupation in the set of explanatory variables (and thus overstandardised earnings) and refers to graduates only. But it is widely quoted in the field as perhaps the first earnings function using the ability variable.

Further earnings functions

Carroll and Ihnen (1967) have used a sample of 87 high school and two-year post-secondary school graduates to study the relationship between education, ability and other variables. Ability was measured as a numerical grade average in high school (A=4, B=3, C=2, D=1, F=0).

After adjusting for a battery of variables (like ability, age mother's education, residence during high school and size of high school class) the differential between the two schooling groups gave an alpha coefficient equal to .73 .

But the limitation of this study is that it dealt only with technical education and that the sample size was very small.

Ashenfelter and Mooney (1968) used a group of male Woodrow Wilson fellows elected between 1958 and 1960. Since all fellows were of the same age and sex, no adjustment was necessary for these two variables.

The dependent variable in the regression was the recorded salary in 1966. Explanatory variables included the field of graduate study, the number of years of graduate study, the highest degree held (B.A., M.A., Ph.D.), profession, number of years of work experience and ability.

Ashenfelter and Mooney used several alternative measures of ability: scores on scholastic aptitude tests, verbal aptitude, Phi Beta Kappa membership, and the average of verbal and mathematics aptitude. The different experiments proved that only the mathematics aptitude related to earnings and therefore it was kept in the regression. The mathematics aptitude was measured on a 200-800 scale. A difference of 300 points produced a difference of $600 per year.

Comparing the coefficients of the years of graduate study variable, before and after control for ability, this study yields an alpha coefficient of .90 .

It should be remembered, however, that this study was concerned with superior graduate students (all elected fellows) and therefore may not be representative of the alpha in the population. On the other hand, methodologically, it is the best study reported thus far in terms of isolating the effect of ability on the earnings differential.

Weisbrod and Karpoff (1968) dealt with a sample of 7,000 male employees with university qualifications of the American Telephone and Telegraph Company in 1956. The variables considered were monthly salary, years of service with the company, rank in college graduation and quality of college. Both the tabulation and regression methods were used.

The tabulation method yielded the following distribution of earnings by ability:

Table 3.5

Index of earnings by class rank in college[a.]

Class rank in college	Index by earnings (100 = sample average)
Top 10 per cent	103.0
Rest $\frac{1}{3}$	99.4
Middle $\frac{1}{3}$	94.4
Lowest $\frac{1}{3}$	91.0

Source: Weisbrod and Karpoff (1968), p.493

a. In colleges of average quality

The above index was used to adjust the earnings of a college graduate for ability. Then the net differential was compared to the gross differential from Census data and an alpha = .75 resulted. This refers to the college to high school differential and adjusts for ability and college quality.

Moreover, regressions were run within each college quality-rank group in order to assess the effect of differential ability on earnings. The results were as follows: each additional year of service yielded the following extra value according to ability (in colleges of average quality).

Table 3.6

Incremental income by class rank

Class Rank	Extra Income
Top 1/10	$182
Rest of top ⅓	158
Middle ⅓	151
Bottom ⅓	151

Source: Weisbrod and Karpoff (1968).

Namely, it [illegible] found that although ability (as measured by rank in class), had an effect in the very top of the class, it did not have much effect for the majority of college graduates.

The above results, however, should be treated with caution as they refer to males only, to employees of one particular company, to graduates only, and as the class rank was the one reported by the employee himself.

Hansen, Weisbrod and Scanlon (1970) used the characteristics of 2,403 men who were rejected from military service in 1963 because they failed to pass the AFQT (Armed Forced Qualification Test). The dependent variable in their earnings function was annual earnings in 1962. Explanatory variables included the number of years of schooling, and AFQT score as a proxy for ability, training outside school, age, colour, marital status, family size and region.

The earnings function when run without the ability variable gave an extra income of $61.5 per year, per one extra year of schooling. The inclusion of the ability variable lowered this value to $30.3, thus giving an alpha coefficient for ability only equal to .49 .

The results of this study can hardly be generalised to the population as a whole. The reason is that they refer to "low achievers"; namely, it is not surprising that differential ability is important among a group whose average ability is very low. Moreover the alpha adjustment centres around an average level of schooling of 8.9 years. Therefore this value of alpha cannot be applied to higher educational levels. (For a controversy on this study see Chiswick 1972, Masters and Ribich 1972 and Hansen, Weisbrod and Scanlon 1972).

Rogers (1969) studied 364 males who were in the 8th or 9th grade in 1935 in Connecticut and Massachusetts. Their earnings were recorded later in 1955, 1960 and 1965. Several earnings functions were run including several alternative proxies for ability: age, IQ, average mark at highest level of schooling and the presence of mental or physical handicap.

In one set of regressions IQ was found to have a non-statistically significant effect on earnings, although age and the presence of a handicap affected earnings. In the final set of regressions the following alphas are implied: .86 for the secondary level and .73 for the higher level (Rogers 1969, p.112).

These alphas include not only an ability adjustment, but parental class, religion, marital status and number of jobs changed. Roger reports that the IQ correction alone did not have any effect on the private rate of return to college education. This was equal to 9 per cent for both an 86 IQ man and an 121 IQ man. (See his table 11).

Rogers' results should be treated with great caution because of the very small sample size and the fact that the observations are limited to certain Eastern U.S. cities. But this study is widely quoted as for the first time evidence on longitudinal earnings by educational level was presented.

Griliches (1970) attempted to conduct the nearly perfect controlled experiment to isolate the effect of ability on education, but unfortunately based on very weak data. Griliches used for his earnings function tabulated data of income reported by taxpayers in Sweden along with their years of schooling and IQ. The total number of observations were 19 table cells. The IQ variable was measured at the age of 10 and was therefore free from most of the effects of education.

The addition of the ability variable to the regression lowered the years of schooling coefficient from .053 to .051, thus implying an alpha equal to .96. However, the fact that the data are averages from tabulations and moreover they refer to income as reported to the tax authorities reduces the generalisation value of this study.

Griliches and Mason (1972) attempted to conduct another controlled experiment in order to differentiate between the effects of ability and education on earnings. For that purpose they used a 1964 sample of 1454 United States veterans and their AFQT score as a measure of ability. Griliches and Mason worked with two different measures of schooling: schooling before and after military service. The latter is not supposed to have influenced the AFQT score and was therefore used in the regressions.

The coefficient of the schooling increment in the regression without the ability variable is equal to .0528. The inclusion of the AFQT score and socioeconomic background (as measured by father's status and region before schooling) lowers the schooling coefficient to .0462. This amounts to an implicit alpha equal to .88 . In view of this finding Griliches and Mason conclude:

> " ...while the usual estimates of the contribution of education may be biased upwards due to the omission of such variables (ability and socioeconomic background) this bias does not appear to be large and is much smaller than 40 per cent originally suggested by Denison".

This conclusion, however, has to be qualified by the fact that they considered military veterans only and a measure of ability one might have doubts about.

Hause (1971) concentrated on the problem of complementarity between ability and schooling. Earnings functions have usually been fitted in an additive form, namely

$$Y = a + bS + cA.$$

This means that Schooling and Ability are perfect substitutes; for if A is increased, the effect of S on Y remains the same.

A more realistic model, however, would have been

$$Y = a' + b'S + c'A + dSA$$

where SA is the multiplicative "interaction term". Now, if A is raised, the effect of S on Y changes as well. If the sign of the d coefficient is positive, then ability and schooling are complements in determining income. If d is negative, then A and S are substitutes. Beyond the sign of the d coefficient, another way to detect complementarity between S and A is to run earnings functions within schooling levels and observing the value of the c coefficient.

Hause analysed evidence from three sources: new tabulations obtained from the Rogers sample, the Project Talent data in the U.S. and the Husen data for Sweden. When earnings functions were run using the Rogers data, within schooling levels, the following results were obtained.

Table 3.7

The effect of ability on earnings by educational level

Educational level	Coefficient of IQ (on log 65 earnings)	Mean IQ
High school dropout	.024	95.9
High school graduate	.700	102.3
College dropout	.360	107.8
B.A.	.910	115.6
B.A. +	1.320	117.3

Source: Hause (1971), pp.295, 291.

Since the effect of ability on earnings rises by the level of schooling, Hause concluded that ability and schooling are complements in determining earnings.

The implicit alpha coefficient resulting from Hause's work is of the order of .94 . This refers to the college level and strictly to the ability adjustment.

The National Bureau of Economic Research - Thorndike sample

Before we examine another work by Hause, let us open a parenthesis and describe a sample known as "NBER-TH". Several earnings functions have been based on this sample and the data are still being mined.

This sample is based on volunteers for Air Force pilot, navigator and bombardier programmes in the United States in 1943. The candidates for such programmes had first to pass a preliminary screening test. The ones who passed this test were then given an additional set of 17 tests to measure their different abilities. These tests were administered in 1943.

In 1955 Thorndike and Hagen sent a questionnaire to these volunteers, including a question on earnings. This sample provided eventually 2,316 observations of earnings and ability. In 1969 the National Bureau of Economic Research sent out another questionnaire on earnings, and therefore earnings data for this sample are available for 1955 and 1969.

The sample's limitations are listed below so that we will not have to qualify later the results of each study that utilised this sample.

(a) The data refer only to volunteers and therefore may not be representative of the population as a whole.

(b) The data refer to males only.

(c) The data exclude persons in the lower spectrum of ability as the Air Force candidates had to pass a preliminary screening test.

(d) The ability variable was measured at an age at which it is likely to have been influenced by education.

Hause (1972) examined further evidence on the question of complementarity between schooling and ability. Using the NBER-TH sample described above he found a significant positive interaction term between ability and schooling. In particular, he found that the difference in one deviation of IQ (equal to 15 IQ points) yielded the following differences in earnings by educational level: $250 at the high school level and $800 at the B.A. level.

The alpha coefficients implied in Hause's work are .97 for the B.A. degree and .89 for further graduate study. These coefficients refer strictly to ability. Using the Rogers sample the alpha coefficient for B.A. was equal to .87 .

Although Hause's work can be easily criticised in terms of the data used, he has pioneered in purging the alpha coefficient from socioeconomic background.

His overall conclusion is that ability adjustments have practically no effect at the less than high school level, and that alpha ranges between .87 and .90 for the higher educational levels.

Gintis (1971) in an effort to discriminate between what he calls the "cognitive" and the "affective" models, compiled evidence on the effect of the inclusion of ability on the regression coefficient of schooling. In Gintis' words,

> "by cognitive characteristics we mean individual capacities to logically combine, analyse, interpret and apply informational symbols. By affective characteristics we mean propensities codified in the individual's personality structures, to respond in stable emotional and motivational patterns, to demands made upon him in concrete social situations".

Consider again the two familiar relationships

$$Y = a + bS \qquad (1)$$

$$Y = a' + b'S + cA \qquad (2)$$

Assume that in (1) the level of schooling is a proxy for cognitive achievement variables. If the cognitive model is correct, then b' in equation (2) should be equal to or near zero. The reason is that the introduction of explicit ability traits (A) in equation (2) has stolen all the explanatory power of education. If, on the other hand, $b' \neq b$, then the affective model is valid. Namely, education affects personality traits and therefore earnings.

Gintis reviewed nine case studies the result being that the introduction of the ability variable did not change significantly the b coefficient of the schooling variable. Therefore, the evidence backed the affective model.

Regardless of Gintis' interpretation, the results surveyed can be used to compute alphas. This is done in Table 3.8 below. The value of alpha ranges between .65 and .96 and it is much nearer to one, in most cases, than Denison's .6 .

Table 3.8

Implied alpha coefficients in 9 case studies

Author	Alpha coefficient
Hansen and Weisbrod (unpublished)	.81
Conlisk (1968)	over .90
Duncan (1968)	.75-.90
Cutright (1969)	.65-.78
Duncan et.al (1968)	.80
Bajema (1969)	.87
Griliches and Mason (1972)	.85-.88
Sewell et.al (1969)	.93
Taubman and Wales (1969)	.96

Source: Based on Gintis (1971), p.277

Alpha equals one minus reduction in the value of the schooling coefficient.

At this point we examine a study which, although has not considered the ability variable explicitly[1] is of some methodological interest. Bowles (1972) reversed the procedure described thus far, namely he first inserted other variables in the regression, like socioeconomic background, and then education, i.e.

$$Y = a + b \text{ (Background)}$$

$$Y = a' + b' \text{ (background)} + cS$$

---

[1] And therefore is not included in the review table 3.9 below.

The logic of this procedure is that socioeconomic background or ability comes before schooling and therefore should be first inserted in the regression. If the inclusion of S does not change the original b coefficient in the first equation above, then it can be concluded that education is not important in determining earnings. And this was in fact Bowles' finding. The alpha coefficient corresponding to a background adjustment was equal to .6 .

Becker (1972) criticised Bowles in that one should study the effect of education on earnings by having all variables in the regression and not by introducing them sequentially. Of course this criticism also applies to the Griliches and Gintis experiments reported earlier as they have first introduced education in the regression and not education and ability simultaneously.

One wonders, however, what would be the result of an exercise where ability is introduced first, and then education. Unfortunately, the literature does not provide such experiment. (Unless one accepts Bowles' social class variable as a proxy for ability). But given the fact (?) that income correlates better with education than ability, the subsequent introduction of the schooling variable may change the regression coefficient on the ability variable.[1]

In a related experiment, Morgenstern (1973) has run first the earnings function with education and socioeconomic background in the set of explanatory variables and then removed the education variable. The result was that the explanatory power of the model (R^2) dropped by over 60 per cent. This finding contradicts Bowles.[1]

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[1] From Griliches and Mason (1972), p.S83 we get the following simple correlation coefficients: Cor(income, ability) = .235; Cor(income, schooling increment) = .329.

Taubman and Wales (1973) have run earnings functions in the United States using the NBER-TH sample of veterans and a battery of 17 ability scores. Only mathematical ability was found to be related to earnings, thus confirming Ashenfelter and Mooney (1968). The alpha coefficient resulting from their work at the higher educational level is .65 . However, this includes ability and socioeconomic background adjustments.[2]

Hauser, Lutterman and Sewell (1971), as reported by Solmon (1973), analysed the earnings of 1,000 high school seniors in Wisconsin in 1957 who responded to a follow-up in 1964. Since all respondents' fathers were farmers in 1957, the earnings were already adjusted for socioeconomic background. The alpha coefficient strictly for ability was equal to .81 . It refers to unspecified years of schooling.

Conlisk (1971) conducted two experiments using the matched data technique reported earlier. In the first experiment he used the results of a longitudinal study on child development. The children were all born in Berkeley, California and their IQ was recorded from infancy to the age of 18. Their terminal education and occupation was recorded at the age of 30. However, no earnings were recorded. Conlisk matched the above children with the Census tabulations of earnings by occupation. In this way 75 average observations were generated on earnings by schooling and IQ. The result of the earnings function fitting was that the addition of IQ did not affect the schooling coefficient. In fact, this experiment yielded an alpha equal to 1.02 when the IQ measure referred to the age of 1-5. But of course this result should be treated with caution in view of the high standard error of the negative IQ regression coefficient in the regression.

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[1] Bowles worked with data from a Census survey covering 20,000 males in 1962. Morgernstern worked with data from the 1968 Urban Problems survey covering 2,700 heads of households in 15 Northern U.S. cities. In both studies, socioeconomic background is measured mainly by parents education.

[2] For a critique of this study see Layard and Psacharopoulos (1974).

In the second experiment, Conlisk matched earnings and schooling categories from the 1950 Census to Army General Classification Test as a measure of ability. This procedure generated 117 average observations and the resulting alpha coefficient was equal to .40 .

The author himself admits that his procedure is weak, and in view of the diverse results we do not include this study in the review table 3.9 below.

We end this survey of the literature with a footnote on the work of Jencks (1972). Jencks used mainly data from the U.S. Census and the project on Equality of Educational Opportunity on the earnings and other characteristics of white non-farm males in the United States. The statistical technique used is that of "path analysis". This is similar to regression analysis with the difference that the effects of one variable onto another can be studied in several successive "paths". For example, father's occupation affects the child's education, which in turn affects the child's occupation and which affects the child's eventual earnings.

Jencks' overall conclusion is that the main determinant of earnings is luck. In fact, the combined effect of education, family background, ability and occupation explains only 22.2 per cent of income variance between individuals (p.245).

This finding has created a great controversy in the United States. But the deficiencies in Jencks' analysis are numerous. Firstly, the earnings of females are excluded. Secondly, the age distribution of earnings is not considered. Thirdly, we do not know if the effects of education and other variables are statistically significant in his model. Fourthly, the effects of education on earnings are found via the individual's occupation. But as mentioned earlier, it is a conceptual mistake to standardise for occupation as the effects of education on earnings are realised by occupational mobility. Jencks states that the direct effect of education on income was found to be small but he does not state what is his criterion of size. Furthermore, Jencks mixes data from different sources in deriving the final paths between variables, and this must have introduced unknown biases in the results. (He also omits weeks and hours worked).

Another reason why Jencks' results have raised scepticism, is that they are in contrast with a host of other studies in the U.S. using special samples and in which the statistical significance of the results is known. For example, the explanatory power of most of these studies is more than double that of Jencks' model.[1]

Where do we stand?

Once Griliches wrote the following on the subject of ability adjustments:

> "This is a very difficult topic with a large literature and very little data" (Griliches 1970, p.92).

This comment is entirely valid today. Although the literature has grown still further, the data on which the analyses reported in this paper are based leave much to be desired. All studies considered in this paper suffer from one or more of the following defects:

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[1] For detailed critiques of Jencks' work see the February 1973 issue of The Harvard Educational Review, and Psacharopoulos (1974).

(a) The sample used is not representative of the population as a whole. The samples we have examined referred mainly to urban white males in particular regions of the United States.

(b) The sample is usually too small to permit a rigorous statistical analysis and consideration of interaction effects.

(c) The ability variable has been usually measured at a late age and therefore has already been affected by education.

The reader should have the feeling that no single study reported above could claim to have solved the perennial problem of ability adjustments. Perhaps a study like the "Douglas children" in England could provide a more firm answer to the problem at hand.[1] But until the results of this study are available, we will have to live with the existing evidence.

Bearing in mind the above qualifications we may attempt a synthesis of the results reviewed thus far. Table 3.9 shows the value of alpha coefficient from the various studies classified by two dimensions: the educational level it refers to, and whether it refers to an ability adjustment only, or to ability plus other factors. "Other factors" in this case stands mainly for socioeconomic background.

Let us now consider some summary statistics resulting from this summary table. The overall average value of alpha is equal to .77 . In other words, regardless of the level of education or the ability - plus other factors distinction, education is responsible for over three-quarters of observed earnings differentials. This is a considerably higher value than Denison's "three-fifths" (α = .60) used almost universally thus far.

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[1] This is a longitudinal follow-up study of 5,000 boys and girls born in 1946. Test scores have been recorded since the age of 5, as well as their earnings now that they are in the labour market. For a description of this study see Douglas (1964) and Douglas, Ross and Simpson (1968).

When we concentrate on the ability adjustment only, then the value of alpha rises to .86 . Therefore, a strict ability adjustment would reduce observed earnings differentials by 14 per cent. This might not be judged as a terribly important adjustment, in spite of what is intuitively thought.

Overall value of alpha

Correction for: - ability only α = .86

- ability plus other factors α = .77

Let us now consider the overall value of alpha by educational level based of course on those studies that have been explicit on the level of education the adjustment refers to. Table 3.10 shows the value of alpha for ability only, and for ability plus other factors, by level of education.

Table 3.9

Proportion of earnings differentials due to education relative to ability and other factors (U.S.A.)

Level of schooling	Adjustment reference	α	Source
Higher education	Ability + other	.67	Denison (1964)
Primary	Ability + other	.88	Denison (1974)[a]
Secondary	" "	.88	
B.A.	" "	.88	
One year graduate study	" "	.48	
Higher	Ability	.80[b]	Becker (1964)
Higher	Ability + other	.65[c]	
Higher	Ability + other	.74[d]	
Higher	Ability + other	.81[e]	
Secondary	" "	.52[d]	
Secondary	" "	.73[e]	
Secondary	Ability + other	.40	Morgan and David (1963)[f]
B.A.	" "	.88	
Graduate study	" "	1.00	
Two years post sec. technical	Ability + other	.73	Carroll and Ihnen (1967)
Graduate study	Ability	.90	Ashenfelter and Mooney (1968)
Higher	Ability + other	.75	Weisbrod and Karpoff (1968)
Years of schooling	Ability	.49	Hansen, Weisbrod and Scanlon (1970)
Secondary	Ability + other	.86	Rogers (1969)
Higher	" "	.73	
Years of schooling	Ability	.96	Griliches (1970)

Continued

Table 3.9 - Continued

Level of schooling	Adjustment reference	α	Source
Years of schooling after mil.serv.	Ability + other	.88	Griliches and Mason (1972)
Higher education	Ability	.94	Hause (1971)
Primary	Ability	1.00	Hause (1972)
Higher	"	.97[g]	
B.A.	"	.87[h]	
Graduate study	"	.89[g]	
Years of schooling	Mostly ability only	.85[i]	Gintis (1971)
Higher	Ability + other	.65	Taubman and Wales (1973)
Years of schooling	Ability	.81	Hauser et.al. (1971)

Source: See text,

Notes:
- a. Based on Table 3.1 above.
- b. Using the Bell data or the Wolfle and Smith data and class rank as a proxy for ability.
- c. Using the Wolfle and Smith data.
- d. Using the Morgan and David results; averages for ages 18-34 and 35-74.
- e. Based on Gorseline; not corrected for under-reporting of earnings.
- f. Refers to the ages 35-44.
- g. Using the NBER-TH sample.
- h. Using the Rogers sample.
- i. Overall average of the alphas implied in Gintis.

Table 3.10

Proportion of earnings differentials due to education; by level of education

Educational level	Alpha coefficient	
	Ability only	Ability + other
Primary	1.00	.94
Secondary	n.a.	.68
Higher	.97[a.]	.79
Graduate study	.89	.82

Source: Based on Table 3.9

Notes: The "ability only" column is from Hause (1972).

a. Using the NBER-TH sample

Unfortunately, the results are so mixed as to preclude any inference on whether the alpha rises or falls by the level of schooling. Hause's work seems to indicate that the alpha is falling by educational level when only the ability factor is controlled for. But no one could generalise this statement as it is based on a single case study. On the other hand, the value of alpha in general is so high that the question of whether it falls or rises by educational level might be considered as trivial.

By way of summary, and subject to the qualifications mentioned earlier our review supports two propositions. Firstly, the greatest part of observed earnings differentials by educational level is due to education. When all available studies are taken into account, this part is greater than it was thought before. Secondly, we cannot be conclusive on whether the value of alpha rises or falls by educational level. Hence, at this agnostic stage, one may continue to use a single value of alpha for all educational levels. And of course this value would have to be well above the 60 per cent used almost universally thus far.

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Chapter 4

EFFECTS OF VARIATIONS IN SCHOOL QUALITY

In the previous chapter we examined evidence on the importance of student ability relative to years of schooling, in determining earnings. The result of our review was that, in spite of intuitive claims, differential ability is not an important factor in determining earnings differentials between graduates of various school levels.

In this chapter we turn to examine the relative importance of another possible determinant of earnings: school quality. The following section explains the rationale behind this issue in terms of alternative policy implications. Then we take a closer look at the quality dimension of education, both from the point of view of measurement and the theoretical reasons why it might affect earnings. The review of the existing evidence on the relationship between earnings and school quality forms the bulk of the chapter. The evidence is preceded by a few methodological points concerning the earnings-education-quality relationship. The last section attempts to draw conclusions from the empirical review.

We will classify the rationale for studying the earnings-quality relationship under four headings:

a. for efficiency
b. for equity
c. for the allocation of students among existing schools
d. for the allocation of new schools among regions.

Efficiency. The immediate rationale for studying the earnings-school quality relationship is for choosing between the extensive and the intensive margin of investment in schooling. There are two ways in which the quality of the labour force (as measured by labour earnings) can be improved: either by increasing the level of schooling of the population (extensive margin) or by improving the quality of schools (intensive margin). Both activities are costly. The problem is how to choose between the two, or in what proportions to use them both?

Consider the following earnings function:

$$Y = a + bS + cQ + dA \quad (1)$$

where Y is the individual's earnings,

S is the quantity of schooling he has received, (e.g. the total number of years he attended school),

Q is a measure of the quality of schooling, (e.g. the amount his community spends on education), and

A is a measure of his ability, (e.g. his IQ level).

The b coefficient in this function shows the strict effect of years of schooling on earnings, controlling for the effect of other factors like school quality (Q) and ability (A). Similarly, the c coefficient shows the strict effect of quality on earnings.

By measuring the S and Q variables in appropriate units, or by transforming them to refer to a common base, comparisons can be made between the b and c coefficients. This comparison can be very useful in formulating educational policy. For example, if $b > c$ the quality of the labour force should be increased by increasing the level of educational attainment of the population. If, however, $c > b$ the quality of the labour force should be increased by providing better schools and not by increasing the number of years of schooling.

One possible transformation of the b and c coefficients is to relate them to the cost of increasing S or improving Q. This would yield rates of return to quantity (r_S) versus quality (r_Q) of schooling. Although there have been plenty of r_S estimates in the literature, evidence on r_Q is scanty. Whatever evidence exists on the returns to quality of schooling is reviewed later in this paper.

Equity. Another use of equation (1), above, is for studying the factors associated with income distribution. Knowledge of the sources of income distribution can be used for policy formulation towards equality. For example, by taking variances of both sides of equation (1), we can express income inequality (measured by Var Y) as a function of the variance (and covariance) of years of schooling, quality, and so on.

$$\text{Var } Y = f(\text{Var } S, \text{Var } Q, \ldots, \text{Cov } SQ, \ldots) \qquad (2)$$

An income distribution policy could then tackle the variable whose variance is mostly associated with the variance of earnings.

S versus Q as policy instruments. Let us open a parenthesis at this point and examine the relationship between the quantity and quality of schooling as policy instruments. Consider two attributes of any policy instrument: a. its effectiveness relative to other instruments, and b. its lending to manipulation by the policy maker.

Comparisons between the b and c coefficients in the earnings function presented earlier refer to the first attribute, above. From this comparison we may conclude, say, that S is more effective than Q. Yet when we come to enforce a policy of increasing S we may find that the variability of this instrument is limited. Whereas Q could be easily used as an instrument (e.g. by increasing public expenditure on schools), a policy of increasing S might be much more difficult to implement (other than at the minimum schooling legislation level).

This point can be made more explicit by considering the main determinants of earnings as possible policy instruments. As shown in Table 4.1 below, the quality of schooling is the most convenient public policy variable in terms of implementation. Therefore, regardless of the relative size of its effectiveness, the Q instrument is important in educational planning because of its ease of implementation.

Table 4.1

Policy relevance of the determinants of earnings

Earnings determinant	Subject to alteration by public policy?
Age	No
Race	No
Sex	No
Socio-economic background	No (in present generation)
Ability (genetic)	No
Quantity of schooling (S)	Yes (for low level S)
Quality of schooling (Q)	Yes

Allocation of students. The efficiency issue discussed earlier referred to the allocation of funds between S and Q. The solution to this problem would involve increased capacity of some kind (either at the extensive or intensive margin).

Now let us turn to another, short term, efficiency problem: The allocation of students by ability to existing schools of differing quality. Depending on whether the quality of schooling is a complement of substitute to ability in determining earnings, one might follow a different policy of allocation of students among schools. For example, if more able students benefit more from better quality schools (i.e. if Q and A are complements) one might advocate a policy of encouraging good students to enroll in schools of high quality. Or, perhaps, should one advocate bussing of low A students to high Q schools?

The extent of complementarity of substitutability between Q and A can be studied by introducing interaction terms in the earnings function, namely:

$$Y = a + bS + cQ + dA + eQA.$$

If $e > o$, then Q and A are complements in determining earnings. Alternatively, the same issue can be analysed by running an earnings function of the type:

$$Y = a + bS + cQ$$

within ability groups. If c classified by ability rises, then A and Q are complements.

Allocation of new schools. Whereas the last issue referred to the efficiency in allocating students among existing schools, this issue refers to whether one should build high or low quality (read, cost) schools, and where to locate them? More precisely, should one build high quality schools in urban areas or in rural areas? Is it discrimination that depresses the earnings of blacks or a low schooling quality? Should one, therefore, build high quality schools in the South of the United States?

The theory

The ad hoc reason for including a quality variable in an earnings function is that Labour is not homogeneous. Controlling for Q one can therefore study the effect of S on Y. Alternatively, one can find the effect of Q on Y, controlling for S. But why should there by an effect of Q on Y? Let us list three theories that have been put forward in this respect.

In the first place we have the *marginal productivity* theory. Better quality means better instruction and transmission of extra skills. Quality improvement is an investment, the returns to which appear as higher earnings of the graduates of better schools. Once expenditures on quality improvements are accepted as an investment, one can talk about the social rate of return to schooling quality.

Next we have the *screening* hypothesis which is in sharp contrast to the marginal productivity theory. The screening hypothesis says that graduates of better schools earn more simply because employers "prefer" them for high paying jobs, relative to graduates of poor quality schools. School quality acts as a screening device at the hiring point. Therefore, the extra earnings of graduates of better schools do not necessarily represent increased marginal productivity. If this theory is correct, one can no longer talk about the social returns to quality improvements. Better quality schools carry a private (transfer) value, but no social value.

The third theory could be summarised as "quality is nothing more than ability". It is a fact that the high quality schools are also very selective. Therefore, what appears as a return to high quality might simply be a return to ability. If this view is adopted, however, the quality issue is reduced to the ability issue discussed in chapter 3, above.

One could carry this argument a little further and claim that what appears as a return to quality is, in fact, a return to the student's socio-economic background, motivation and the like. The real challenge, therefore, is to devise tests for isolating the effect of quality. In the context of our methodology it would mean introducing simultaneously into the earnings function measures of school quality, student ability, social class and the like.

What quality?

In the above we have been talking loosely about "quality" without trying to specify it further. In this section we discuss alternative measures of school quality.

Let us distinguish three major groups of quality variables:

a. by school expenditure

b. by a non-expenditure assessment of schools

c. by student quality.

The variable par excellence for measuring school quality has been the average per pupil expenditure. (Hirsch and Segelhorst 1965, Hunt 1963, Morgan and Sirageldin 1968, Rogers 1969, Johnson and Stafford 1973, Morgenstern 1973 and Solmon 1973). The expenditure variable may refer to a particular school or, more commonly, to the whole State where the school is located (if the individuals providing the observations were educated in different States).

Although convenient, this variable has several major shortcomings. Firstly, there is enormous school expenditure variation within States. Secondly, it is not clear whether the school expenditure refers to instructional costs only, or includes library and research costs.[1] Thirdly, a high expenditure does not necessarily mean better quality. That is, the efficiency with which the school budget is used is not made explicit. Finally, private expenditure on schools is not captured by State school finance statistics.

It is for the above reasons that some researchers have resorted to cost-independent measures of school quality. These include:

a. the teacher-pupil ratio (Welch 1966)

b. the class size (Carroll and Ihnen 1967)

c. the school's reputation, like being in the "top ten" in the U.S. (Johnson and Stafford, 1974) or Oxbridge, in England (Metcalf 1974).

Lastly, some researchers have used a measure of the student ability as a proxy for the institution's quality (Hunt 1963, Solmon 1973, Reed and Miller 1970). However, it should be noted that the ability variable is an average for the whole student body of a particular school and does not vary over particular individuals (as in the previous chapter). Evidently, the right procedure would be to introduce both a non-ability and an ability variable in the regression in order to discriminate between the effects of Q and A.

There have been two popular quality indices used by some researchers. (e.g. Link 1973, Solmon 1973, Wales 1973). These are the Astin index and the Gourman index.

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[1] Although Welch (1966) and Solmon (1973) have dealt explicitly with teachers' salaries.

Astin (1965) used factor analysis to summarise a host of student and institution characteristics into a selectivity index and an intellectualism index. Selectivity refers not only to the percentage of entrants relative to applicants, but also takes into account the institution's operating budget, research funds, scholarship funds and library size. The intellectualism index reflects mainly the students' high school grades. It should be noted that the correlation coefficient between selectivity and intellectualism is nearly .8.

The Gourman (1967) index is used to rate the academic quality of undergraduate colleges based on fellowship granting foundations and industrial opinion, staff publications, curriculum and student services. In short, Gourman's index is based on a consensus of reliable academic and industrial opinion about the institution's excellence.

A review of the evidence

Ideally, what we would like to deduce from the following review is the importance of the quality variable in explaining the variance of earnings (for people with the same amount of schooling and similar further characteristics). In order to arrive at this evidence, one should have either the partial coefficient of determination between earnings and quality, controlling for other variables, or the so-called "beta" coefficient, (see chapter 3, above).

Unfortunately, these statistics cannot always be derived from published results. Different authors were interested in testing different hypotheses and, of course, they publish what they consider relevant. Therefore, in our review we will have to resort to second best statistics, like the increase of the variance explained by adding the quality variable or the monetary effect of one unit of schooling relative to one unit of quality. Obviously, problems of measurement units arise, but we have improvised in each case so as to arrive at some meaningful comparisons.

Hunt (1963) is perhaps the first study that attempted to introduce a school quality variable in an earnings function. In analysing the incomes of 2,625 college graduates as reported to a Time magazine survey in 1947, Hunt tried two alternative measures of quality among his explanatory variables:

Q_1 = college prestige as measured by the average ability of the student body;

Q_2 = college expenditure per pupil.

The coefficient on Q_1 proved not significantly different from zero in the regression. Per pupil expenditure, however, was found to have a significant effect on earnings. The total variance of earnings explained with the inclusion of the Q variable was 22 per cent.

Hunt summarised the effect of Q on lifetime earnings by estimating rates of return to expenditures on improving schooling quality (r_Q). This was found equal to 12 per cent and is higher than the returns to years of schooling (r_S) at the college level (equal to about 9 per cent in the U.S.). When student ability was introduced in the regression, however, the returns to college quality were approximately halved. The following table presents the returns to college quality classified by student ability.

Table 4.2

Returns to College Quality by Student Ability

Ability level[a.]	r_Q[b.] (per cent)
50	3.6
75	4.2
100	5.0
125	5.6
150	6.4

Source: Hunt (1963), p.350.

a. This refers to Hunt's own ability index and not to I.Q.

b. For the business field only.

This table gives us the first hint that ability and quality complement each other. The returns to Q are double for the more able students relative to the less able ones.

The limitations of Hunt's study, however, are that it used a rather small sample, income instead of earnings, and dealt only with graduates. But it gave the first clue as to the complementarity between Q and A, something not even discussed by Hunt in the interpretation of his results.

Hirsch and Segelhorst (1965) analysed the incomes of 238 persons with less than college education. The independent variables in the regression included years of schooling, sex, occupation, age, family background and school quality. Quality was measured by per pupil expenditures. This is one of the few studies from which we can infer the relative importance of each independent variable in explaining income variance. The ranking of selected variables appears in Table 4.3.

Table 4.3

Relative importance of selected variables in explaining earnings

Independent Variable	Explained income variance (percentage)
Years of schooling	7.8
Sex	7.8
Occupation	6.8
Age	3.6
Quality of schooling	3.4
Family background	1.2

Source: Hirsch and Segelhorst (1965), p.396.

The total explained variance by all independent variables in this study is 40 per cent. Education is the single major contributor (7.8 per cent), followed by sex, occupation and age. The quality of schooling explains about half of the variance explained by the years of schooling (3.4 per cent). When the earnings function was fitted separately for males, years of schooling explained 11.6 per cent of the variance of income.

The results of this study should be treated with caution. Firstly, income was used instead of earnings. Secondly, the sample size is extremely small (N = 238) for the results to be generalised. Moreover, occupation was included in the set of explanatory variables. As noted in the previous chapter, one should not control for occupation in an earnings function. For it is through occupational mobility that the returns to quantity and quality of schooling could be realised. To put it in another way, the effects of Q on Y in this study have been biased downward by controlling for occupation.

Welch (1966) investigated the relationship between the 1959 incomes of rural males and two indices of school quality:

Q_1 = level of teachers' salaries and

Q_2 = the teacher-pupil ratio.

The observations refer to averages for 45 states.

Welch's analysis is very aggregative and difficult to interpret. What appears relevant for our review is that teacher salaries had a positive effect on the quality of schooling whereas a high teacher-pupil ratio had a negative effect on Q.

Carroll and Ihnen (1967) studied a sample of 45 graduates of post-secondary technical schools and 42 graduates of secondary schools as the control group. Independent variables included ability (see chapter 3, above), family background, weeks worked, locality and school quality. The quality variable was measured by the class size.

The coefficient of the Q variable in the regression was negative and statistically significant. Each additional pupil in the class had the effect of reducing the monthly earnings of the rest by 8 cents. The overall explained variance of earnings in this work is 55 per cent. But this result should be qualified by the small sample size and the restricted range of educational levels considered.

Morgan and Sirageldin (1968) were directly concerned with the effect of schooling quality on earnings. For this purpose they studied the earnings of 1,525 heads of households who were not self employed or farmers. Explanatory variables included age, sex, race, years of schooling, locality and school quality. The last variable was measured by the average per pupil state expenditure on education.

Morgan and Sirageldin followed a slightly different methodology than the ones reported thus far. As a first step they remove the variance of earnings due to sex, age, race and years of schooling. Then they regress the residual earnings on the quality of schooling. The result was as follows for the primary and secondary level:

$$\begin{Bmatrix}\text{Residual}\\ \text{hourly}\\ \text{earnings}\end{Bmatrix} = -8.35 + \underset{(.00037)}{.0025Q} \quad , \quad R^2 = .07$$

In other words, the quality of education explains 7 per cent of the earnings variance of those of the same age, sex, race and years of schooling. This figure is about double the one reported earlier by Hirsch and Segelhorst.

Morgan and Sirageldin used a different measure of quality for the college level. This is a selectivity index developed by Cass and Birnbaum (1964). This Q measure reflects the percentage entrants relative to applicants and the average ability of the student body. The following table shows gross and residual earnings by college quality. (The residual earnings are obtained by subtracting expected earnings standardised for sex, race, etc. from actual earnings).

Table 4.4

Earnings by College Quality

College quality	Gross earnings	Residual earnings
Most selective	$15,200	$3,264
Selective	9,450	104
Non-selective	8,400	-745

Source: Morgan and Sirageldin (1968)

As shown in this table the effect of college quality on earnings is reduced when earnings are standardised for other factors like sex and race.

Morgan and Sirageldin also estimate the rate of return to expenditure on improving schooling quality. This was found equal to 15 per cent and is slightly higher than the one reported earlier by Hunt before standardisation for individual student ability. Of course, Morgan and Sirageldin did not standardise for student ability when considering the quality variable.

Weisbrod and Karpoff's (1968) study is based on 7,000 employees of the American Telephone and Telegraph Company. All individuals are males with college degrees. Monthly earnings were analysed in conjunction with ability (measured by college class rank), years of service with the company and college quality. Quality was assessed by the Company's Personnel Officer, and colleges were classified into four groups: best, above average, average and below average. Weisbrod and Karpoff used both the tabulation method and earnings function analysis in studying the effect of Q on Y.

When earnings were standardised for age, the following cross tabulation resulted:

Table 4.5

Earnings of college graduates by college quality and student ability[c] (Selected cells)

Student ability (A)	College quality (Q)		
	Best	Average	Below average
Top[a]	119	103	103
Middle	104	94	94
Lowest[b]	97	91	90

Source: Weisbrod and Karpoff (1968), p.493.

a. Refers to top 10 per cent of the ability distribution

b. Refers to the lowest $\frac{1}{3}$

c. 100 = overall sample mean.

Since we will meet similar cross-tabulations later in this paper, some explanation and caution on how to interpret them is in order at this stage. One way of reading the table is by concentrating on horizontal or vertical differences between figures located in the corners:

	Q	
A	119	103
	97	90

Horizontal Δ = 16

Horizontal Δ = 7

For example, the earnings gap by Q widens as we move from low A students to top A students (7 compared to 16). This might be interpreted as evidence of complementarity between student ability and college quality. In other words, more able students benefit more from high quality colleges.

But this corner figure comparison should be qualified immediately as depending upon the distribution of the variables. This comparison would only be valid if the top category and the bottom category referred to the same percentile. Clearly this is not the case for the A variable (top 10 per cent compared to lowest $\frac{1}{3}$), and the same applies to the arbitrary distinction between "best" and "below average" Q.

Another way of reading a table of this kind is to concentrate the middle, off-diagonal, figures:

		Q	
		103	
A	104		94
		91	

Horizontal Δ = 10
Vertical Δ = 12

Since these figures refer to the centre of the respective distributions, the horizontal difference represents the effect of quality holding ability constant (= 10 in our case) while the vertical difference (=12) represents the effect of ability holding quality constant.

The comparison of these differences might be interpreted as the effect of ability being stronger than the effect of quality. However, this result should be further qualified by the fact that these figures are derived from a cross-tabulation and therefore one is unable to judge their statistical significance.

In another analysis earnings functions were fitted within Q and A groups in order to assess the effect of Q on Y controlling for A and vice versa. (It should be noted that the level of schooling is already controlled for as all individuals are college graduates). The earnings function was of the following form:

$$Y = a + b \text{ (Years of experience)}.$$

The b value in \$ is tabulated below by A and Q.

Table 4.6

Value of one extra year of experience by college quality and student ability (in \$)

Student ability (A)	College quality (Q)		
	Best	Average	Below average
Top	199	182	167
Middle	187	151	162
Lowest	146	151	156

Source: Weisbrod and Karpoff (1968), p.496.

This tabulation confirms, in some sense, the previous one. Years of service become increasingly valuable for the more able graduates of good schools. Concentrating on the cross-figures (as explained above) the effect of ability ($\Delta = 31$) appears to be higher than the effect of quality ($\Delta = 25$). Alternatively, controlling for ability (i.e. reading the middle row) one can isolate the effect of college quality.

Finally, Weisbrod and Karpoff estimate that the difference between the best and worst quality college means $14,200 over the lifetime earnings of an individual of average ability (p.497, Table 3a). For a top ability student the corresponding difference would have been $21,500 and for a low ability student $10,700. Once again, college quality matters more to the more able student.

Rogers' (1969) main concern was the effect of ability on earnings (see chapter 3, above). However, in analysing the earnings of 364 males he included a school expenditure variable. Although this variable was included in the regression as an alternative proxy for ability, it is in fact what others have used as a proxy for school quality. Whatever interpretation one gives to the school expenditure variable it proved statistically insignificant. (In fact it correlated negatively with earnings; R = -.19).

Daniere and Mechling (1970) used data from a special survey by the Bureau of Social Science Research and 1960 Census data to study the relationship between earnings, ability and college quality. The tabulation method was used throughout this study.

The ability variable was measured by the student's verbal SAT[1] score. This defined five ability classes (A1> 98.5%, A2 = 90-98.5, A3 = 70-90, A4 = 25-70 and A5< 25). College quality was measured by the institution's instruction cost per pupil. In this way three quality categories were defined (Q1> $1900, Q2 = 1000 - 1899, and Q3< 1000).

Daniere and Mechling present their results in terms of discounted extra lifetime earnings of college graduates over high school graduates. (In the following cross-tabulation earnings have been rounded to the nearest $1000).

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[1] Scholastic Aptitude Test, administered by the College Entrance Examination Board of New York.

Table 4.7

Lifetime earnings differential between college and high school graduates by college quality and student ability (in $)

Ability	Quality		
	Top	Middle	Bottom
Top 1	65,000	53,000	-
2	66,000	50,000	38,000
Middle 3	57,000	37,000	30,000
4	54,000	34,000	22,000
Bottom 5	-	30,000	14,000

Source: Daniere and Mechling (1970), p.56.

Concentrating at the middle-A, middle-Q figures we see that the effect of quality ($\Delta Y = \$27,000$) is greater than the effect of ability ($\Delta Y = \$23,000$). This is in contrast to the result obtained earlier by Weisbrod and Karpoff (1968). Moreover, through similar cross-tabulations Daniere and Mechling confirmed the complementarity between student ability and college quality. Taking into account the cost of quality improvements the authors reach the conclusion that additional college places should go in preference to students of higher ability; but these places should be created in low cost institutions.

There are several limitations in the above analysis: No earnings function was used and, therefore, one cannot establish the statistical significance of the results. No control is allowed for variables other than A and Q. The verbal SAT score was used as a proxy for ability whereas other studies have shown that only the mathematical score relates to earnings (Astenfelter and Mooney 1968, Taubman and Wales 1973). Lastly, the instruction cost only was taken as a proxy for college quality thus neglecting library and research expenditures.

Reed and Miller (1970) used data from a special survey of the Bureau of the Census conducted in 1967. The study group consisted of 2,559 males with college degrees. The data referred to average weekly earnings, age, race, father's occupation, region, field of study and college quality. Quality was measured by the average (verbal and mathematical) aptitude of freshmen in a given college. In other words, an average index of the ability of the student body was used as a proxy for college quality.

As a first step, weekly earnings were separately regressed against each independent variable. As shown in the following table, college quality was the next single important determinant of earnings for the B.A. level. But for higher degrees it is the field of specialisation that counts first (7.2 per cent of earnings variance explained), while quality comes in third place with 4.8 per cent of the variance explained.

Table 4.8

Percentage explained variance of earnings by single independent variables

Characteristic	Educational level	
	B.A.	B.A.+
Age	7.9	3.9
College quality	4.2	4.8
Field of specialisation	4.0	7.2
Colour	.8	1.2
Father's occupation	.4	.7

Source: Reed and Miller (1970), p.180.

In another part of the analysis the effect of college quality on annual earnings has been as follows (controlling for age, field of specialisation and colour).

	B.A.	B.A.+
Gain in attending best school relative to worst school.	\$4,400	6,100

Therefore, the effect of quality appear to be stronger at the higher educational level.

The main limitation of this study is that A was used as a proxy for Q, instead of including both A[1] and Q in the regression. Therefore, the effects of quality reported in this study are biased upwards. And although the dependent variable is treated throughout this study as "earnings", it includes income from the operation of a farm or business.

Johnson and Stafford (1973) studied 1,039 white, non-farm male household heads in order to arrive at social returns to quality as opposed to quantity of schooling. Earnings were related to years of education, years of experience, region and school quality. Quality was measured by the per pupil State expenditure on education.

When the earnings function was fitted excluding the Q variable, the coefficient on the years of schooling was as follows:

$$\text{Log } Y = \text{const.} + .0779 \, S$$

Inclusion of the quality variable did not "steal" much of the effect of the years of schooling, i.e.

$$\text{Log } Y = \text{const.} + .0760 \, S + .2 \text{ Log } Q.$$

What this result means is that if we are interested in the effects of years of schooling on earnings, the omission of the Q variable would not bias upward the coefficient on S. The .2 coefficient of the quality variable can be interpreted as the elasticity of income with respect to expenditure on quality improvements. Its size suggests positive but diminishing returns to improvements in school quality.

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[1] Namely, an ability measure referring to each individual student rather than average A for the whole student body.

Johnson and Stafford computed marginal social rates of return to quality improvements for given educational levels. The quality margin was defined as the last $25 of expenditure.

Table 4.9

Returns to quality of schooling by educational level (percentage)

Change in expenditure per pupil (in $)	Educational Level		
	Elementary	Secondary	College
From 125 to 150	21.0	16.6	14.1
From 275 to 300	17.3	13.6	11.9
From 400 to 425	16.3	13.4	11.6

Source: Johnson and Stafford (1973), p.150.

Table 4.10

Returns to quantity of schooling by level of quality (percentage)

Educational level	Quality level		
	$150	300	400
High school (vs. elementary)	11.5	10.9	10.5
College (vs. high school)	8.5	8.8	9.0

Source: Johnson and Stafford (1973), p.149.

Table 4.9 reveals that although the relative *importance* of quality is small in explaining the variance of earnings, expenditures on quality improvements at the margin have a *high rate of return*. In fact, the returns to quality improvements are higher than the returns to increasing the number of years of schooling, as shown in Table 4.10. On the basis of these results, Johnson and Stafford advocate reallocation of resources away from schooling quantity towards improving schooling quality.

Two limitations should be mentioned regarding the analysis presented above. Firstly, there was no control for student ability. Secondly, the Q referred to average State expenditure per pupil and therefore conceals expenditure variations between different schools in the same State.

Johnson and Stafford (1974) studied the earnings of another sample referring to academic economists. The independent variables were years of experience, sex and graduate school quality. The Q variable was defined as a 0-1 dummy depending on whether the individual was a graduate of the so-called "big ten" U.S. universities (e.g. Harvard, Chicago, Yale, etc.). The fact that one was a graduate of such school was found to add 6 per cent to his annual earnings, controlling for sex and experience. But this result can be qualified as being too specific to one particular occupation (academic economists) and to one particular educational level (Ph.D.).

Morgenstern (1973) analysed the earnings of 1,624 household heads in 1968 in relation to years of schooling, experience, socio-economic background and school quality. The Q variable was measured by the average per pupil State expenditure on education.

This work is of methodological importance as an attempt is made to distinguish between the direct effect of Q on Y from the indirect one, namely $Q \longrightarrow S \longrightarrow Y$. For this purpose Morgenstern fits the following models:

$$Y = f\ (S,\ Q,\ \text{Background}) \qquad (1)$$

$$S = g\ (Q,\ \text{Background}) \qquad (2)$$

$$Y = h\ (Q,\ \text{Background}) \qquad (3)$$

Model (1) revealed that school quality had a significant direct effect only on the earnings of blacks. The rate of return on quality expenditures was equal to 10 per cent.

Model (2) revealed that quality is an important determinant of educational attainment. More specifically, a 10 per cent increase of per pupil expenditures is associated with an additional .18 years of schooling for blacks and .11 for whites.

Model (3) revealed that when S is withdrawn from the regression (relative to model 1), the effect of Q on Y is approximately doubled. Moreover, the earnings of whites are now significantly affected by the quality variable.

The main conclusion of this study has been that although Q has a small direct effect on earnings, it has a strong indirect effect by influencing the number of years of schooling attained.

Link (1973) studied the earnings of 759 male chemical engineers in 1961. The independent variables were years of schooling, degree held, ability, experience and college quality. College quality was measured by the accreditation of specific engineering departments by the Engineers' Council for Professional Development. Astin's indices of selectivity and intellectualism were used as alternative student ability variables.

It is worth underlining that Link used as a student ability measure what others have used as an institution quality measure (e.g. Morgan and Sirageldin, Hunt, Reed and Miller,, and Solmon). Astin's indices are certainly not appropriate as ability measures as they do not vary between individual graduates of the same institution.

But Link's strong point is that he experiments with alternative combinations of Q and A in the earnings function, like:

$$Y = f(S, Q, \text{other variables}) \quad (1)$$

$$Y = g(S, A, \text{other variables}) \quad (2)$$

$$Y = h(S, Q, A, \text{other variables}) \quad (3)$$

The first model yielded the result that being a graduate of an accredited department adds $759 to the individual's annual earnings. Addition of the intellectualism index as a proxy for ability in model (3) lowered the above Q coefficient to $468. This demonstrates the point made earlier that unless both Q and A are introduced simultaneously in the regression the effect of Q is biased upwards.

Model (2) gave the result that one extra point on the Astin's selectivity scale (which has a mean equal to 50) adds $47 to the individual's earnings. Model (2) explains 45.2 per cent of the variance of earnings. The addition of Q added .1 per cent to the model's explanatory power (as judged from the R^2 of model 3). Once again, we get the result that Q alone (i.e. when controlling for other variables) does not account for a large part of the residual variance of earnings.

This paragraph exploits evidence from Link (1973) regarding the value of the α coefficient. The following table presents earnings differentials by educational level before and after adjustment for ability (i.e. by using models 1 and 2, respectively).

Table 4.11

Crude vs. ability-adjusted earnings differentials

Educational levels compared	Earnings differential	
	Uncontrolled for ability	Controlled for ability
Ph.D. (vs. Master's)	$1,365	$1,364
Master's (vs. Bachelor's)	492	428
Bachelor's (vs. college dropout)	698	748

Source: Based on Link (1973), p.244

This evidence is in line with our conclusion in the previous chapter that the empirical value of the α coefficient is nearer to 1.[illegible] than .6.

Taubman and Wales (1973) analysed the earnings of 5,000 veterans in relation to years of schooling, ability and schooling quality. *Wales* (1973) using the same sample reported in greater detail the effects of quality.

College quality has been measured by Gourman's index. It was found that scaling the quality variable into fifths, only the two top fifths affected earnings in a significant way. After controlling for ability, the addition of the Q variable adds 1 per cent to the explained variance of earnings. Although small in absolute size, this is the highest incremental R^2 reported thus far.

Wales reports earnings differentials by years of schooling before and after controlling for college quality, as in Table 4.12. This table clearly demonstrates that the effect of college quality is higher, the higher the level of education.

Table 4.12

Earnings differentials relative to high school graduates by college quality (percentage)

Educational level	Not controlling for quality[a]	Controlling for quality	
		Low Q	High Q
College dropout	17	14	37
B.A., M.A.	30	29	39
Ph.D.	63	53	98

Source: Wales (1973), p.314.

[a] All figures are already controlled for ability, religion, marital status, age and background variables.

Solmon (1973) used the same NBER-TH sample of veterans as Taubman and Wales, in order to study in greater depth the role of college quality in the determination of earnings. Solmon dealt only with those with 13+ years of schooling and, therefore, the sample size was reduced to 1,600. The independent variables included years of schooling, student ability, experience and college quality.

Solmon experimented with six alternative measures of quality: Faculty salary, total school expenditure, school income, Gourman's index, Astin's indices of intellectuality and selectivity and the average SAT score of the student body. The percentage of explained earnings variance by all independent variables is of the order of 8 per cent, being one of the lowest reported R^2's. However, the incremental R^2, by adding the quality variable, is as high as .022 (i.e. adding 2.2 per cent to the explained variance).

Solmon was able to determine the relative importance of the six quality variables in explaining the variance of earnings. Judging from the t-ratio of the corresponding regression coefficient or by the incremental R^2, the ranking of the alternative Q variables appears as follows:

1st : Faculty salary
2nd : SAT score
. . . .
Last : Per student expenditure

Two propositions follow from this ranking: Firstly, there exist both instructional (as measured by faculty salary) and "peer" (as measured by SAT of the student body) effects of Q on earnings. Secondly, the most popular Q variable used thus far, namely per student expenditure, is the worst when compared with alternative measures. Of course, this finding raises doubts about the results obtained by other researchers whose only Q variable was the school expenditure.

Solmon also provides evidence on the effect of controlling quality on the rate of return to college education. Becker's estimate of 13 per cent drops to 9.7 per cent when college quality is controlled for. Solmon's estimate of 7 per cent for his particular sample drops to 3 per cent, and the return to college education in the larger Taubman and Wales sample is lowered by 30 per cent when Q is controlled for. Finally, Solmon tests for interaction between college quality and student ability. The result simply confirmed the findings reported earlier that Q and A are complements in determining earnings.

All the studies reported thus far have used U.S. data. Although there exists a sizeable literature on earnings functions in other countries, practically none has considered the quality aspect of schooling. The only exception is Metcalf (1974) who analysed the salaries of 1,258 university lecturers in the U.K. The independent variables included age, subject, degree held and university of first degree. The last variable could be interpreted as reflecting schooling quality. The results suggested that graduation from a foreign university adds more to earnings, while graduation from Oxbridge had the highest effect among domestic institutions. The quality variable explained only .04 per cent of the residual variance of the earnings of university lecturers. However, the total explained variance (by all variables) in this study is the highest ever reported ($R^2 = .69$).

How important is schooling quality?

It should be obvious that the preceding survey of existing results is not enough to provide firm answers to the policy questions listed earlier in this chapter. The role of schooling quality in the process of earnings determination remains clouded for a number of reasons: Sample sizes were relatively small or too specific for particular groups of people or educational levels, and the statistical significance of statements on the effect of quality cannot always be established. Moreover, there seems to be a fundamental confusion in the literature as to whether one should introduce simultaneously in the earnings function independent measures of schooling quality and student ability, or simply use an average measure of student ability as a proxy for institutional quality. Subject to the above qualifications, we attempt in this section to bring together the results of several studies on given topics. This would hopefully provide an overview of the role of schooling quality at the present state of the arts.

On the question of what quality measure should be used, it appears that most studies, because of data availability, have used the wrong measure (average school expenditure). The two major defects of this measure is that it conceals individual variations within school districts or States and has little to do with the efficiency with which instruction takes place. As Solmon (1973) demonstrated, it is faculty salary rather than overall school expenditure that determines schooling quality. Moreover, faculty salary is superior as a measure of quality to the average ability of the student body.

The issue is not as clear on whether one should use quality only, or ability plus quality variables in an earnings function. As demonstrated in chapter 3 ability differences are not very important in determining the earnings differential between graduates and non-graduates. However, the omission of the ability variable would bias upwards the effect of schooling quality on earnings. But if both A and Q variables are included in the regression then one runs into problems of multicollinearity.[1] The best way out of this dilemma seems to be the use of a recursive model in which ability and quality separately determine parts of the system. Although

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[1] Solmon (1973) reports that the correlation between Gourman's quality index and the students' SAT score is .6.

Morgenstern (1973) has used a recursive system, the choice of variables and function specification are such as to preclude any inference on this issue.

Let us now turn to the variance of earnings explained by the quality variable, when other variables have been controlled for. As demonstrated in table 4.13 there seems to exist a consensus on this issue:

Table 4.13

Percentage variance of earnings explained by schooling quality, controlling for other variables

Partial correlation coefficient x 100	Source
3.4	Hirsch and Segelhorst (1965)
7.0	Morgan and Sirageldin (1968)
4.2	Reed and Miller (1970)
1.4	Johnson and Stafford (1973)
.4	Metcalf (1974)

Although there exists wide variation among the partial correlation coefficients between the quality variable and earnings, the absolute size of the explained variance is small.

An alternative way of looking at the importance of the quality variable in explaining earnings is by comparing the explanatory power of the whole model before and after the inclusion of the quality variable.

Table 4.14

Incremental explained variance of earnings by adding the quality variable (percentage)

Incremental R^2 x 100	Source
.8	Johnson and Stafford (1973)
.1	Link (1973)
1.0	Wales (1973)
.9 - 2.2[1]	Solmon (1973)

[1] Depending on whether school expenditure or faculty salary, respectively, is used as a proxy for quality.

Table 4.14 simply confirms the previous statement that the marginal explanatory power of schooling quality is small.

For the sake of reference, the total explanatory power of all variables in the regressions is given in Table 4.15 below. This is, of course, a more widely published statistic than the partial correlation coefficient or the incremental R^2 reported above.

Table 4.15

Percentage variance of earnings explained by all independent variables (including schooling quality)

R^2 x (100)	Source
22	Hunt (1963)
40	Hirsch and Segelhorst (1965)
55	Carroll and Ihnen (1967)
36	Rogers (1969)
18	Reed and Miller (1970)
36	Johnson and Stafford (1973)
47	Johnson and Stafford (1974)
25	Morgenstern (1973)
45	Link (1973)
15	Wales (1973)
8	Solmon (1973)
69	Metcalf (1974)

Although the explanatory power of quality is small, the returns to expenditure on quality improvements are not small. A better college quality means $4,000 extra per year in the Morgan and Sirageldin sample or an extra 6 per cent of the annual salary in the Johnson and Stafford sample. In terms of lifetime earnings, a better college means $14,200 extra in the Weisbrod and Karpoff sample or $27,000 in the Daniere and Mechling study.[1]

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[1] All figures quoted in this paragraph are net of ability and other factors.

When such earnings differentials are related to the necessary expenditure that can bring about the quality improvement, one arrives at the rate of return to schooling quality. The four studies that computed the returns to schooling quality found yields equal to or above the yield of expenditures on increasing the number of years of schooling (Table 4.16). However, the evidence is still so scanty that one could not recommend reshuffling educational expenditures from the extensive towards the intensive margin.

Table 4.16

Rates of return to expenditures on schooling quality (percentage)

r_Q	Source
5 - 12[a]	Hunt (1963)
15	Morgan and Sirageldin (1968)
12 - 17[b]	Johnson and Stafford (1973)
10	Morgenstern (1973)

a. After and before ability adjustment, respectively.

b. Figures refer to elementary and college education, respectively.

One issue on which there appears to exist consensus is that schooling quality and student ability are complements. At least five studies have demonstrated the complementarity between Q and A (Hunt 1963, Weisbrod and Karpoff 1968, Daniere and Mechling 1970, Reed and Miller 1970 and Solmon 1973). Therefore, on strict economic efficiency grounds, more able students should enrol at "centers of excellence" whereas less able students should enrol at low cost institutions. But note that in view of equity considerations, the above policy prescription can be easily reversed.

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Chapter 5

MONOPOLY ELEMENTS IN EARNINGS FROM EDUCATION

To what extent are earnings differentials between more and less educated persons generated by monopoly power rather than education? The reason we are interested in monopoly incomes is that if, for example, medical doctors earn more than other graduates, the extra earnings might be attributed to restrictions of entry into medical schools rather than to medical training. Relaxing restrictions to entry would presumably bring doctors' earnings in line with earnings in other occupations. In what follows we first examine what is really meant by "monopoly income" and ways to identify its existence or non-existence. Then we examine earnings in different occupations in many countries and try to assess whether they have been generated by monopoly power.

Let us start by describing the process by which monopoly incomes can arise in a professional labour market. We will assume that the market is initially in equilibrium. Figure 5.1 depicts the supply and demand conditions in a hypothetical market for medical doctors. The vertical axis measures the annual salary of the last doctor employed, while the horizontal axis measures the number of doctors practising in this economy or the equivalent in total physician services. The demand curve (D_1) is downward sloping as additional physician services will only be demanded at a lower price. The initial supply curve (S_1) is upward sloping as doctors face rising costs for providing extra services. The supply and demand curves intersect at point A, where 200,000 doctors are employed in the economy and their salary is \$15,000 per year. This salary is not judged as "excessive" or as a "monopoly income" since people in similar professions (like dentists or lawyers) earn about the same.

Then assume that the local medical association decides to raise professional standards. Doctors are now required to spend two extra years in training before qualifying for practice. This would have the effect of shifting the supply curve upwards to S_2, as the cost of producing a doctor has increased. The new supply curve intersects the demand curve at point B which corresponds to a number of doctors equal to 180,000 and a salary equal to $20,000. Although the market is still in equilibrium at point B, the increased costs resulted in less people entering the medical profession and those who enter (or who are already practising) receiving a higher salary.

Doctors now earn $5,000 more relative to other professions. Are we allowed to conclude that the medical profession enjoys "monopoly incomes"? The answer is clearly no. Although doctors already in the profession earn a rent (as they qualified under lower costs) this rent is a short run phenomenon and should disappear within a generation or so. To put it in the economists' jargon, it is a "quasi-rent" rather than a monopoly profit. For new entrants the extra $5,000 represents a compensating differential to allow for the cost of longer training. Therefore, our first conclusion is that one can never assess whether a monopoly income exists or not by simply comparing earnings in different professions. The cost of training has also to be taken into account.

Let us further assume that the local medical association decides now to restrict the number of physician licences to 140,000. The alleged reason for doing so might be to protect the consumer from badly trained overseas doctors flooding into the country. The real reason, however, might be to secure higher incomes for its members. The result of this restriction would be a supply curve (S_3) rising steeply after the 140,000 doctors mark.

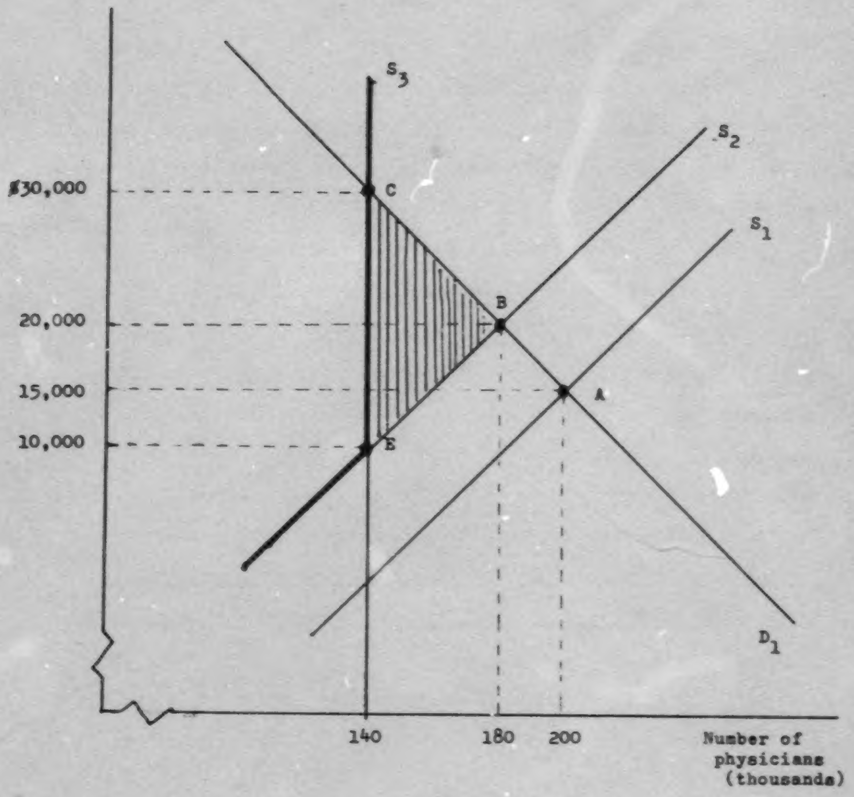

Figure 5.1. Monopoly incomes and resource allocation.

Whatever the price, additional doctors cannot enter into the profession. The association's members earn $30,000 per year which can now be characterised as a monopoly income. The reason is the GE discrepancy between the demand price and the supply price. Therefore, in order to establish the existence of a monopoly income one must document a divergence between the earnings in a profession and the cost of producing the last person who enters the profession. In our particular case, the difference between the demand price and the supply price is $20,000 and this represents a monopoly rent as long as the restriction on the number of doctors is enforced.

Implicit in the above discussion (largely drawn from Rottenberg, 1962) is the distinction between "regulation" and "restriction". The shift of the supply curve from S_1 to S_2 was due to regulation which is not associated with monopoly incomes. However, the further shift of the supply curve from S_2 to S_3 is due to restriction which gives rise to monopoly incomes. Since the supply and demand curves are not exactly known in practice, it is very difficult to distinguish between regulation and restriction (Richardson, 1971).

At this point we should also clear a common pitfall in monopoly income discussions. Assume that the supply and demand curves in Figure 5.1 refer to the social cost and the social value of medicine, respectively. The existence of monopoly incomes does not mean that there exists a discrepancy between the social marginal product of physician services and the wage rate. The imposed restriction produces an intersection on the marginal productivity schedule for doctors (point C). The lower labour input simply raised the value marginal product of the last doctor employed (Bowen 1963).

So, what is wrong with monopoly incomes? Let us classify our discussion under the following headings:

a. Resource allocation,

b. Income distribution, and

c. Returns to education.

Referring back to Figure 5.1, the restriction of practice to 140,000 doctors results to a social cost equal to the area CBE. The reason is that there exists a "profit" associated with the practice of the 140,001th doctor equal to the CE discrepancy. In other words, although it costs society $10,000 to produce his annual services, his services are worth $30,000. Continuing in the same manner for the 140,002d to the 180,000th doctors yield a resource misallocation cost equal to the shaded area CBE. In our particular example the misallocation cost amounts to $800,000,000. If the GNP in this (not so) hypothetical economy were $800 billions, monopoly incomes of just one profession would amount to .1 per cent of the GNP. This cost is similar to that found in other monopoly areas in the economy (see Harberger, 1959 and Leibenstein 1966).

Misallocation of resources can be conceived as between different occupations within the same country (e.g. between doctors and lawyers), between different regions within the same country (e.g. a particular State enforcing its own medical examinations to restrict practice), or even between countries (e.g. via restriction of immigration of doctors from low producitivity to high productivity countries). In all cases, relaxation of the restrictions would mean higher product either within a country or on a world-wide scale. The extent of the resource misallocation cost depends upon the elasticity of the supply and demand curves. In Figure 5.1 these curves have been shown to be elastic. But the more inelastic the demand for particular services, the higher would be the misallocation cost involved.

It should also be obvious that restrictive practices give rise to pockets of high incomes in the economy relative to non-restricted professions. Therefore, policies against restrictive practices would improve income distribution.

The backbone of much of the analyses discussed in this volume is the earnings differential between more and less educated labour. If the earnings of the more educated labour are produced by monopoly power, are we allowed to attribute the earnings differential to education? Let us again take medical education as an example. The earnings differential between a doctor and a high school graduate is $20,000. A part of this differential might have been produced by differential ability required to enter the medical school (an issue we dealt with in chapter 3 of this book). Another part, however, might be due to the monopoly power exercised by the doctors' association rather than due to medical training.

Note that the social rate of return to investment in education based on the crude differential would be correct. In other words, the restriction of entry has the effect of raising the rate of return beyond what it would otherwise have been. The problem, however, is to disentangle how much of the extra return is due to the restricted practice.

Two further methodological points are in order before we present the monopoly evidence. The first refers to the direction of the overtime (dynamic) adjustment which sometimes might work towards equilibrium or away from equilibrium. For example, a rise in the rates of return to medical education might suggest increasing restriction if those rates were high relative to alternatives. Otherwise, the rise of the rates of return would represent a movement towards rather than away from equilibrium.

The second point refers to monetary versus non-monetary measures of restriction.[1] For example, profitability measures of different professions represent monetary measures. Queues and ratios of admissions to applicants represent non-monetary measures. In what follows we have concentrated heavily on the former kind of measure. The first reason for this treatment is data availability. The second reason is that non-monetary measures have their own defects. For example, if it is well known that entry into the medical school is restricted, applications would drop not because of a lack of demand for medical school places, but rather to avoid frustration. In this case, admissions-to-applicants ratios would be clearly biased.

The evidence

In an analysis that was to become a classic, Friedman and Kuznets (1945) examined the incomes in five professions in the United States; Physicians, dentists, lawyers, accountants and engineers. Although the period to which the data refer (1929-37) is a little remote, we report their analysis in some detail as it contains many important methodological points.

As a first step Friedman and Kuznets establish a substantial difference between the level of income in the above five professions as a whole and income in other activities. Professionals received 2.5 to 3.5 times the average income of other workers. The first explanatory factor they examine is the relative variability of incomes. In other words, a profession with a high transitory income component would also command a higher average level of income as a premium against uncertainty. Although not absolutely conclusive, the evidence suggested a greater variance in professional versus non-professional incomes. This is also true even within the group of professionals. As shown in Table 5.1, doctors have a higher income than dentists, and also doctors' incomes are more variable than dentists' incomes.

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[1] For an elaboration of the concepts of excess and shortage, see Arrow and Capron (1959) and Bowman (1963).

Table 5.1

Level and variability of incomes by occupation, U.S.A., 1934

Occupation	Income level	Coefficient of variation
Doctor	$3,431	1.28
Dentist	$2,387	.78

Source: Friedman and Kuznets (1945), pp. 104,106

Note: The coefficient of variation is equal to the standard deviation divided by the mean.

Then they proceed to examine the effects of location, as professionals live in urban areas with higher incomes. When standardised for community size, professional incomes exceed non-professional incomes by up to 180 per cent (in the same community). Accounting for the higher training costs of professionals reduced the above earnings differential to 70 per cent. This remaining difference is attributed to restrictions to entry into professional activities. Friedman and Kuznets identify two sources of such restrictions:

a. lack of the necessary ability to become a professional, and

b. Lack of the necessary funds to finance lengthy training.

Therefore, the authors concluded that professional workers as a whole constitute a "non-competing group". Namely, by virtue of talent and funds they are in a favourable position relative to others. Or, since the supply of talent and funds is limited, others are excluded from entering the professionals' group.

After sorting out the overall differences between professionals as a whole and other occupations, Friedman and Kuznets concentrate on income differences within the group of professionals. In this way they standardise for ability, as, say, doctors and dentists might be both of equal intellectual capacity. The average incomes of doctors and dentists were as follows (in the 1929-34 period):

Doctors	$4,081
Dentists	$3,081

Or, doctors earn 32.5 per cent in excess of dentists. Part of this differential is, of course, a compensation for the fact that doctors' training is lengthier than that of dentists. Taking into account differential training costs, the authors conclude that a 17 per cent excess earnings of doctors over dentists would be fair. However, the difference between the observed 32.5 per cent differential and the equilibrium 17.0 per cent differential must be attributed to restrictions to entry. Friedman and Kuznets identify three such possible restrictions:

a. Doctors might still have a higher level of ability than dentists,

b. There exists a lack of adequate medical school training facilities, and

c. There exists a deliberate policy of limiting the total number of physicians in the U.S. economy.

The authors are very careful as not to jump to any harsh conclusion from their analysis. But the hint they give is very clear: about half of the observed earnings differential between doctors and dentists represents a monopoly income. The following tabulation shows that the rate of acceptance into medical schools declined between 1926 and 1941 in the United States.

Table 5.2

Rate of acceptance into medical schools, U.S.A.

Year	Accepted students as percentage of applicants
1926	64.2
1941	57.2

Source: Friedman and Kuznets (1945), p.14

The Friedman and Kuznets study, although very important methodologically, deals with professional earnings at a point in time too particular for its results to be generalised.[1] Therefore, let us proceed to more contemporary analyses that have explicitly estimated the returns to medical education.

In another classic study Blank and Stigler (1957) analysed the earnings of several technological professions like chemists and engineers. Although their work is painstaking, it is of little use to our problem. The reason is that they have mainly dealt with the relative income position of different professions, disregarding the production costs. As explained earlier in this paper, unless the earnings of a given profession are related to the training costs, one cannot establish the existence of monopoly incomes.

Hansen (1964) criticised the use of doctor-to-population ratios or the relative income position of doctors in assessing whether there exists a shortage or surplus in the profession. For this purpose he went back to the Friedman and Kuznets study and estimated rates of return to medical education. If these returns rise over time this is evidence of shortage. Moreover, if these returns are higher than the returns to alternative forms of investment this is a case of monopoly incomes.[1]

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[1] For a critique of this study see Lewis (1963).

Using U.S. Census and special survey data, he computed rates of return to physicians, dentists and college graduates in 1939, 1949 and 1956. Table 5.3 shows the basic costs and benefits on which the rates of return are based. Note that although physicians in 1956 earned $19,730 a year this is not "excessive" relative to other professions when comparing it to the relative costs. The rates of return appearing in Table 5.4 are by no means "excessive" and, in spite of intuitive feelings, do not support the existence of monopoly incomes. Other forms of investment can certainly yield higher returns than those appearing in Table 5.4.

What is more important is that the rates of return are declining over time suggesting that any existing shortage or under-investment in medical education is diminishing. But the differences in magnitudes are very small in this study and, therefore, no firm conclusion can be reached.

Holen (1965) looked at a particular aspect of resource misallocation by restrictive practices: The effects of state licensing arrangements in medicine, dentistry and law on interstate labour mobility. If barriers to mobility exist between different states, then professionals will be restricted from working where their value marginal product is highest. Her figures show that this applies to doctors more than to dentists and lawyers. This is attributed to exclusionary practices of various state licensing boards in dentistry. Moreover, states with high average per capita incomes exhibit high failure rates among applicants for practice. The correlation coefficients between failure rates and state income are:

- law	.73
- dentistry	.53

Surprisingly, there does not exist any statistical association between the two variables for medicine.

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[1] Of course, these are necessary but not sufficient conditions for the existence of monopoly incomes.

Table 5.3

Earnings and training costs, U.S.A.

(in dollars)

Average annual earnings	Year		
	1939	1949	1956
High school graduate	1,980	4,315	5,985
College graduate	3,306	7,470	10,366
Physician	5,674	13,883	19,730
Dentist	3,512	8,674	12,358
Total cost of training			
College graduates	3,767	9,090	13,299
Physician	9,815	24,310	38,905
Dentist	7,943	17,913	27,749

Source: Hansen (1964), p.87.

Table 5.4

Rates of return by speciality, U.S.A.

(percentage)

Specialty	Year		
	1939	1949	1956
College graduates	13.7	11.5	11.6
Physicians	13.5	13.4	12.8
Dentists	12.3	13.4	12.0

Source: Hansen (1964), p.86.

Benham, Maurizi and Reder (1968) also used state observations to analyse the relationship between doctors' and dentists' incomes, their location of practice and other state and individual characteristics. Table 5.5 reports some of the authors' findings. Doctors' and dentists' income was regressed on the number of medical places in the State, the barriers to entry (as measured by the percentage of applicants for licensure who fail examinations) and a set of other variables not reported here. Although the results are mixed, they confirm the earlier finding that it is dentists rather than physicians who benefit from barriers to entry. For dentists, the exam failure rate is positively and significantly associated with higher income. The physicians' earnings are negatively related to barriers to entry and the statistical significance of the regressions coefficients is less than the one for dentists. Furthermore, the availability of training facilities does not seem to be significantly related with income in either profession. And the explanatory power of all variables diminishes over time.

Carol and Parry (1968) used 1960 U.S. Census data to compute net present values in sixty-seven occupations. Using a 5 per cent discount rate they estimated what each occupation is worth over the individual's lifetime, after deduction of costs. Table 5.6 shows the relative ranking of selected occupations. Once again, dentists come first on the list while physicians rank fifth. It should be noted that difficult-to-enter blue collar fields (like tool-and-die makers, machinists, electricians and plumbers) do often better in terms of lifetime earnings, than occupations requiring lengthier training.

Table 5.5

Regression coefficients of state doctors' and dentists' income on selected variables, U.S.A.

Year	Training facilities	Barriers to entry	R^2	Occupation
1928	-.84 (.05)	-8.67 (.29)	.14	Physicians
1941	10.61 (.51)	-46.97 (2.00)	.45	
1949	9.92 (.79)	-25.18 (1.01)	.22	
1960	-48.62 (1.50)	-132.65 (1.93)	.10	
1963	59.36 (.93)	-67.29 (1.42)	.04	
1929	11.00 (.56)	9.20 (1.19)	.68	Dentists
1937	-20.32 (2.02)	-7.49 (1.01)	.64	
1948	33.25 (.80)	61.99 (2.70)	.19	
1961	-6.08 (.35)	59.01 (5.03)	.49	
1963	-14.86 (.17)	38.27 (1.47)	.06	

Source: Benham, Maurizi and Reder (1968), p.342.

Notes: Numbers in parentheses are t-ratios. Other variables in the regression are state per capita income, state population living in urban areas of more than 2,500 persons and per capita number of medics in the state.

Table 5.6

Discounted net lifetime earnings in selected occupations, U.S.A.

Rank	Occupation	Net present value (in $)
1	Dentists	109,070
5	Physicians and surgeons	94,448
8	Toolmakers, die makers and setters	88,447
10	Lawyers and judges	85,984
14	Accountants	81,059
17	Electricians	79,586
21	Plumbers and pipe fitters	77,390
27	Machinists and job setters	75,416
40	Teachers, secondary school	64,477
45	Medical and dental technicians	61,139
67	Kitchen workers (except private household)	27,569

Source: Carol and Parry (1968), pp. 186-7.

Note: Based on a 5 per cent discount rate and after tax earnings.

Sloan (1970) studied the supply response of residents in various specialties to lifetime earnings. Using a special survey on doctors' salaries he produced net present values to general practice and nine specialties in 1955, 1959 and 1965. The internal rates of return to four years of medical school plus one year of internship were found to be rather substantial (see Table 5.7). However, the returns to the specialties over general practice as the control group, were on the low side and sometimes negative. Radiology was the specialty with the highest rate of return or net present value (see Table 5.8).

Table 5.7

Rates of return to four years of medical school and one year internship

(percentage)

Year	Rate of return
1955	29.1
1959	23.7
1965	24.1

Source: Sloan (1970), p.49

Table 5.8

Present values and rates of return to medical specialties over general practice, U.S.A., 1965

Specialty	Present value (i = 5%)	Rates of return (per cent)
Anaesthesiology	$ 26,464	10.0
General surgery	3,250	5.2
Internal medicine	-29,321	1.5
Obstetrics - Gynaecology	-1,279	4.8
Ophthalmology	67,937	12.4
Orthopaedic surgery	167.599	13.8
Paediatrics	-36,298	negative
Psychiatry	-8,662	3.9
Radiology	115,107	16.1

Source : Sloan (1970), p.48.

Fein and Weber (1971) using data from a variety of sources, estimated the private rate of return to an M.D. with a Bachelor's degree in 1966 equal to 15.1 per cent. This figure corresponds to their assumption of zero annual income growth and no military experience as to be comparable with the other figures reported in this review.

Furthermore, Fein and Weber report time series rates of return to medical training contained in another study by Sloan (1968). These rates are shown in Table 5.9, and are evidently calculated on different assumptions than those reported earlier by the same author (Tables 5.7 and 5.8). Apart from 1941 (which might have been a particular year for comparison with the rest) no clear overtime trend of the return to education can be detected.

Table 5.9

Rates of return to physicians' education, U.S.A.

(percentage)

Year	Rate of return
1941	13.2
1947	17.9
1959	14.7
1962	16.6
1963	15.9
1964	16.1
1965	17.5
1966	18.2

Source: Sloan (1968), p.164 as cited by Fein and Weber (1971), p.246.

Richardson (1971) repeated the Friedman and Kuznets experiment reported earlier using, however, improved statistical techniques and data at several points in time. The estimated rates of return to physicians relative to dentists as the control group appear in Table 5.10. These rates represent the compensation to about 2.5 extra years of training for physicians. However, physicians work about ⅕ longer hours than dentists. When the extra hours of physicians are valued at $4.75 per hour, the rate of return to physicians over dentists falls to zero. To put it in other words, the two professions are equally profitable after adjustment for hours worked.

Table 5.10

Rates of return to G.P. physicians vs. G.P. dentists

(percentage)

Year	Rate of return
1936	8.3
1949	18.0
1952	12.9
1955	13.0
1959	26.8
1962	26.7
1963	25.0
1965	20.9

Source: Richardson (1971), p.96

Note: Rates are before adjustment for hours worked.

Using male college graduates as an alternative control group the rates of return to medicine appear as follows in 1965:

- Before correction for hours worked	22.8%
- After correction for hours worked	17.0%

In spite of the drastic reduction of the returns after the adjustment, the fact remains that medical education is more profitable than, say, a 10 per cent alternative rate and also the returns have been rising over time. In view of this evidence, and after several qualifications, the author concludes that there have been restrictions on entry into the U.S. medical sector as a whole. This is because of the rising rates of return to medical education over time.

Richardson also estimated the returns to nine specialties over general practice. The results shown in Table 5.11 confirm earlier findings of wide dispersion between the return to different specialties. Anaesthesiology and radiology yield the highest rewards, while the returns to internal medicine and psychiatry are very low. What is important for our purposes is whether the differential returns are due to restrictions on entry. But no statistical relationship was found between the returns to different specialties and failure rates on certifying examinations (Table 5.11).

The reduction in the apparent high returns to certain professions after adjusting for hours worked is made clear in the work of Eckaus (1973a). (For a summary, see also Eckaus 1973b). Using 1960 U.S. Census data he estimated the return to education within 70 occupations. Table 5.12 shows the estimates for selected occupations before and after standardising to 2,000 hours of work per year. The results are consistent with earlier findings that dentists are better off than doctors.

Table 5.11

Returns to medical specialties and failure rates on board examinations, U.S.A. 1965

(percentage)

Specialty	Rate of return	Failure rate
Paediatrics	Negative	17
Anaesthesiology	36.0	n.a.
Internal medicine	1.5	n.a.
Psychiatry	.5	51
Obstetrics - Gynaecology	7.3	32
Ophthalmology	18.7	18
Radiology	27.0	29
General surgery	6.3	17
Orthopaedic surgery	20.2	34

Source: Richardson (1971), pp. 204, 227.

Notes: Returns are relative to general practice.
n.a. = not available.

Table 5.12

Returns to education within selected occupations, before and after adjustment for hours worked, U.S.A. 1960

(percentage)

Occupation	Private rate of return	
	Crude	Hours-adjusted
Accountants	negative	negative
Dentists	37.5	19.5
Lawyers	4.0	negative
Physicians	9.0	5.0
Managers, employed	over 100.0	over 100.0

Source: Eckaus (1973a), Table 3.

Note: All rates of return refer to 5 years or more of college relative to 4 years of college.

Lindsay (1973) studied the relationship between hours worked and the returns to medical education in the U.S. For this purpose he re-calculated the net present values of doctor training using the data of three existing studies, before and after adjusting for hours worked.

In the first place, Friedman and Kuznets' (1945) 1.17 warranted differential of the earnings of doctors relative to dentists become 1.32 after taking into account the fact that doctors work 62 hours/week while dentists work only 55. The 1.32 value happens to be exactly equal to the one observed by Friedman and Kuznets and, therefore, this finding implies no restriction to entry into the medical profession. Table 5.13 shows that the Fein and Weber (1971) earnings data when adjusted downwards from 62 to 40 hours worked gave a negative present value at the 10 per cent rate of discount. That is, medical training not only did not imply a monopoly income, but was also unprofitable! The same result was obtained by recomputing Sloan's (1970) rates. Adjustment for hours worked gave a modest present value in 1959 and a negative value in 1955.

Table 5.13

Net present values to medical training before and after adjustment for hours worked

Study	Year	Net present value (in $)	
		Crude	Adjusted for hours
Fein and Weber (1971)	1966	24,376	-4,580
Sloan (1970)	1955	33,542	39,841
	1959	-11,660	1,950

Source: Lindsay (1973), pp. 338, 340.

Note: All adjustments are to 40 hours worked.
Discount rate used equal to 10 per cent.

Turning to England, Morris (forthcoming) estimated rates of return to medical practitioners using the 1966 follow-up sample of the Census of Population. The rates of return to different occupations appear in Table 5.14. As in the case of the United States, medical education in England does not appear to exhibit "excessive" private returns.

The Pilkington (1960) Report looked into the doctors', dentists' and other professions remuneration. Table 5.15 shows median annual earnings and lifetime earnings at a zero discount rate. The last column in this table adjusts for the differential age distribution of earnings within professions. As shown in this table, many other professions exhibit higher earnings than doctors. Of course, consultants is the top category, followed by actuaries.

Table 5.14

Rates of return by occupation, U.K. 1966

(percentage)

Occupation	Rate of return
Medical practitioners	16.8
Architects	13.4
Solicitors	19.9
Accountants	19.3

Source: Morris (forthcoming),
Table 10.

It is worth noting that all National Health Service doctors earn exactly over their lifetime as much as all graduates in industry. This is certainly not evidence of existence of monopoly profits in the medical profession.

The U.K. Royal Commission (1972) up-dated the figures reported earlier. Table 5.16 reveals the same pattern, namely that many occupations exhibit higher earnings than doctors. This is also the case with the recent figures from the U.K. Department of Employment (Table 5.17). Academic university staff appear to earn, in fact, more than doctors and dentists in general. This is, of course, surprising and one wonders whether the low returns to medical training might be caused by under-reporting of earnings. The same picture is revealed in the latest 1973 survey of earnings of the U.K. Department of Employment(Table 5.18).

Turning to another country, Lévy-Garboua (1973) analysed the data of the 1970 I.N.S.E.E. survey on the earnings of qualified persons in France. The results in Table 5.19 indicate that doctors in France earn about double the amount of higher education graduates in general. Unfortunately, these figures have not been related to costs and therefore we cannot assert whether doctors in France enjoy monopoly profits.

Table 5.15

Annual and lifetime earnings by occupation, U.K. 1955/56

Occupation	Annual income	Lifetime income
General medical practitioners	£2,100	£79,000
Consultants	3,353	117,000
Senior hospital medical officers	1,974	73,000
All N.H.S. doctors	..	84,000
General dental practitioners	2,273	79,000
Accountants	1,814	71,000
Actuaries	2,785	105,000
Barristers	2,075	92,000
Solicitors (England and Wales)	2,205	88,000
Architects	1,365	54,000
Engineers	1,497	59,000
University teachers	1,541	63,000
Graduates in industry	1,660	84,000

Source: Pilkington (1960), pp. 40, 44.

Table 5.16

Annual earnings by occupation, U.K., 1971-72

Occupation	Annual earnings
House officer	£1,755
Senior house officer (minimum)	2,040
Registrar (minimum)	2,328
Senior registrar (4th point)	3,237
Consultant	5,676
Barristers (1967-68)	3,210
Solicitors (1968-69)	5,373
Architects (1969-70)	3,613
Actuaries (1968-69)	5,300
Engineers (median)	2,841
Chemists (median)	3,220
Physicists (1964-65)	3,300
University teachers (1968-69)	2,570
University professor	5,808
Head teacher, grammar school	4,360

Source: U.K. Royal Commission (1972), pp. 52, 54-56.

Note: All figures are means unless specified otherwise.

Table 5.17

Earnings by occupation, U.K., April 1972

Occupation	Annual earnings
Civil engineer	£2,631
University academic staff	3,380
School teacher	2,189
Medical or dental practitioner	3,224
Accountant	2,324
Surveyor	2,215
Miner, underground	1,799

Source: U.K. Department of Employment (1972).

Note: Weekly median earnings multiplied by 52 weeks for all occupations.

Table 5.18

Earnings by occupation, U.K. April 1973

Occupation	Annual earnings
Accountants	£2,574
Civil servants	3,016
University academic staff	3,968
Medical practitioners	3,136

Source: U.K. Department of Employment (19[illegible])

Table 5.19

Peak-annual and lifetime earnings by occupation, France, 1970

Occupation	Peak annual earnings	Lifetime earnings
Doctor	F 119,600	F 900,680
All higher education graduates	56,900	420,630

Source: Based on Lévy-Garboua (1973), pp. 13, 32.

Note: Lifetime earnings discounted at zero interest rate.

For evidence on the possible existence of monopoly incomes in other countries we turn to the work of Scitovsky (1966a and 1966b). The author's main concern was to test the hypothesis that with the advancement of democracy and availability of university places, the status of the professional classes worsens over time. Furthermore (in a cross-sectional sense) if, say, France has more democracy than America, then professional incomes would be depressed in France relative to America. In other words Scitovsky tests for the existence of supply effects depressing professional incomes. In the presence of such supply effects certain categories of professionals might try to defend their interests by restricting supply.

Scitovsky studied five professions in eight countries from about 1900 to 1960. The professions were medicine, law, dentistry, university teaching and higher civil service. The countries were the U.S., Canada, U.K., France, Germany, Denmark, Sweden and Norway. Considering professionals as a whole first, Scitovsky shows that there exists a supply effect. In Figure 5.2 the salary of a professional relative to an unskilled worker is plotted against enrollment in higher education. The majority of countries fall within the shaded area. Namely, the higher the university enrollment rate, the lower the professional salary.

Turning to particular professions Scitovsky compares earnings within countries relative to the country's per capita income. Concentrating on the most recent data, Table 5.20 shows the relative positions of the five professions in the eight countries studied. Reading horizontally, medical doctors are better off than other professions in most countries. A notable exception is university professors in Germany who are better off than doctors. Reading vertically (within occupations) doctors are doing better in the U.S., U.K., France and Sweden relative to other countries. However, such comparisons should be treated with caution as all figures do not refer to the same year. Moreover, evidence on monopoly incomes cannot be established by only looking at the revenue side. The costs of training must be taken into account as well.

But Scitovsky's work is a landmark in comparisons of this kind because of the time-series versus the cross-sectional dimension of his analysis. Table 5.21 shows the over time movement of the number of physicians per 100,000 inhabitants in the United States along with their absolute and relative earnings. However, the reader has already been warned about apparent comparisons of this type.

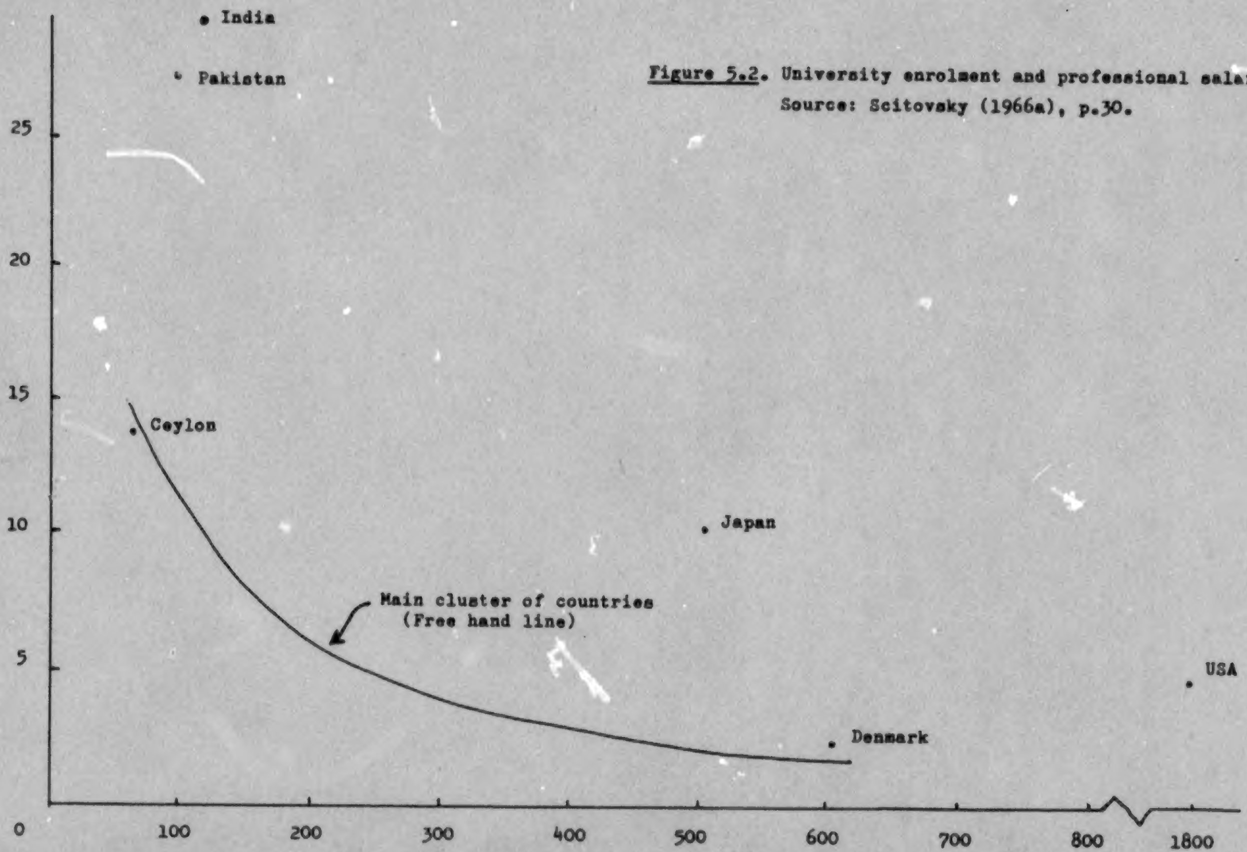

Figure 5.2. University enrolment and professional salaries.
Source: Scitovsky (1966a), p.30.

Table 5.20

Professional earnings by occupation as multiple of per capita income

Country \ Occupation	Doctors	Dentists	Professors	Lawyers	Top level civil servants
U.S.A.	4.2	2.8	2.1	2.4	4.1
U.K.	4.3	3.3	3.8	3.2	8.9
Canada	2.9	2.1	2.0	2.6	4.1
France	4.8	5.5	2.9	n.a.	3.7
Germany	2.6	1.9	4.1	2.9	6.7
Denmark	3.0	n.a.	2.3	2.6	2.6
Norway	2.2	2.4	2.1	2.2	2.2
Sweden	4.2	2.2	2.4	3.9	2.6

Source: Scitovsky (1966a), pp. 35, 38-40.

Note: Figures refer to most recent year.

Table 5.21

Physicians, U.S.A.: Time series of professional earnings

Year	Physicians per 100,000 inhabitants	Annual professional earnings	
		In $	As multiple of per capita income
1900	156		
1910	146		
1920	137		
1928	125		
1929		5,224	2.9
1930	126	4,870	3.2
1931	128	3,700	
1939	132	4,230	3.2
1948	136	11,330	3.2
1950	134	12,320	3.3
1951		13,430	3.2
1952	132		
1956	132	19,180	3.8
1958	132	21,570	4.2

Source: Scitovsky (1966a), p.35 and Scitovsky (1966b), p.186

Do educational restrictions generate monopoly incomes?

In this chapter we have presented a large body of evidence on the existence or non-existence of monopoly incomes. This evidence could be divided into two parts:

a. Symptomatic or intuitive evidence, like physicians-to-population ratios and relative earnings in different professions, and

b. evidence that could really help us in assessing the existence or non-existence of monopoly incomes like benefit-cost ratios.

For reasons stated in the introduction, evidence under a. above, is deficient for our purposes and therefore cannot be called in support of the hypothesis of existence of monopoly incomes. Therefore, we have to concentrate on evidence under b.

As a postscript, let us illustrate this by considering the most recent data on doctors and dentists in the U.K. The NHS scale salaries as of 1 April, 1973 were as in Table 5.22. The stocks of doctors and dentists as well as the annual intake of the respective schools appear in Table 5.23.

Table 5.22

Doctors and dentists salaries, U.K., 1973

Category	Annual salary
House officer	£2,061
Senior house officer	2,664
Registrar	3,192
Senior registrar	3,855
Consultant	6,341
General dental surgery	3,882

Source: U.K. Royal Commission (1973)

Table 5.23

Stocks and flows of doctors and dentists, U.K.

Category	Doctors		Dentists	
	Stock	Annual intake	Stock	Annual intake
General practitioners	23,250			
Hospital training grades	16,700			
Consultants	11,500			
All dentists			12,054	
1962				590
1972				878
1960		2,020		
1970		2,870		

Source: U.K. Royal Commission (1972).

Although doctors appear to earn more than dentists one should take into account the fact that dentists start their career earlier (age 22 or 23) and go directly into practice. Doctors graduate from the medical school at the age 23 or 24. Then they spend at least one year at a house officer post in order to qualify for registration with the British Medical Council.

It is only then that they can enter general practice, unless they follow a hospital career. The latter involves several extra years in training posts as Senior House Officer, Registrar, Senior Registrar and eventually (and also, hopefully), consultant. The typical age of entry into general practice is 30 while the typical age of becoming Consultant is 37. To all that one must add the longer hours of work, particularly during the junior training posts.

The evidence on cost-benefit analysis presented in this paper suggests that although the existence of monopoly incomes cannot be dismissed its extent is not as much as intuitively thought. There are several factors accounting for this conclusion:

a. The higher training costs of those with higher eventual incomes.

b. The longer hours worked of those with higher incomes, and

c. The lifetime aspect rather than a cross-sectional comparison at a given age.

The simple comparison of incomes of different professions, as traditionally done by the layman, would mask all three factors above.

With respect to particular professions it can be said that dentists are better off than doctors in general and that this might be the result of restrictions. Within the group of doctors, certain specialities like anaesthesiology and radiology seem to generate rents. It cannot be established, however, whether these rents are transitory in nature (quasi rents) or that they will disappear as more doctors are attracted to them.

The conclusion that the existing evidence does not fully support the existence of monopoly incomes becomes stronger when qualified as follows. Our main concern is the role of schools in the generation of monopoly incomes. Whether monopoly incomes exist or not, it should be noted that restriction of the output of schools is but one method of preserving monopoly incomes, (U.K. Monopolies Commission 1970). Other methods include imposition of further (non-schooling) costs, age, nationality and sex discrimination as well as restrictions on immigration. Further costs include examination, entrance and subscription fees. For example, the cost of the M.R.C.P. examination in the U.K. is £55, while the annual subscription to the London Stock Exchange is £262. Age limits are set by professional bodies for sitting at qualifying examinations or for corporate membership. For example, the working rule of membership to the Association of Professional Engineers in the U.K. is 27 years old. Until very recently, the London Stock Exchange did not admit women. Furthermore, the U.K. Law Society and the Stock Exchange restrict membership to British subjects.

Immigration restrictions are more common in the medical profession. Under the excuse of domestic consumer protection the local medical association usually asks for a demonstration of competence by foreign doctors. For example, in the U.S., foreign doctors have to pass the E.C.F.M.G. (Examination Council for Foreign Medical Graduates). Furthermore, restrictions on doctor's mobility is imposed even within countries, e.g. by the State licensing boards in the U.S. Immigration restrictions can, of course, account for differences in doctors' earnings between countries. For example, one of the reasons why relative doctors' incomes are depressed in the U.K. relative to the U.S. is that British immigration controls on doctors are less tight than in America.

Therefore, there exist a host of difficulties of entry into a profession other than education. Hence monopoly incomes are not only generated by education. But against this qualification, the possibility of under-reporting of incomes in the medical profession must be stated. Most of the U.S. doctors' earnings analyses presented in this paper utilise data from Medical Economics. The hypothesis cannot be rejected that professional bodies have interest in withholding information on the exact earnings of their members.

Another counter-qualification is that the hours worked adjustment might have been carried too far. If physicians are happy with the amount of hours they work and have an upward sloping supply curve for their services, then one sho not correct their earnings downwards in the hours-worked-adjustment process. The reason is that such individuals might place a lower value on leisure than the one suggested by the last hour worked, and therefore experience no disutility by working longer hours (Richardson, 1971).

Furthermore, the possibility of restriction via increases in the cost of study must be mentioned here. If, say, the doctors' association requires excessive training for the sake of quality and if this training does not necessarily increase doctors' productivity, then this is a case of restriction. Less doctors would be employed because of the increased cost. At the same time, the returns to medical education might appear "normal". (Sloan 1973, p.346). Of course, the available evidence cannot establish whether such kind of restriction exists or not.

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Chapter 6

THE FRINGE BENEFITS OF EDUCATION

Earnings data, as usually recorded in official statistics, do not take into account fringe benefits. If more educated labour enjoys more fringe benefits than less educated labour, crude earnings differentials underestimate the returns to education. There exist hundreds of items of fringe benefits in addition to basic pay. These range from pensions, life assurance and stock option schemes, to subsidised meals and holidays. Of course, in our survey we would like to include all of them, but unfortunately we are restricted by the available data.

How to quantify non-pecuniary fringes?

A total compensation package, call it Y, can be decomposed into three parts.

(a) Basic pay, Y_b, which reflects the time rate or, in the case of civil servants, their grade and step in pay scales.

(b) Pecuniary fringes, F_p, such as life assurance and paid leave, and

(c) Non-pecuniary fringes, F_n, like leisure time and working conditions (e.g. use of air-conditioned office).

In assessing the true pay package

$$Y = Y_b + F_p + F_n ,$$

the obvious question is how to put a monetary value on the second component of fringes, F_n.

Some of the items within the non-pecuniary category of fringes can be quantified, for example, by applying the person's wage rate to his leisure hours. But note that this is not entirely satisfactory as the person might be willing to work overtime at a higher rate of pay. He might even place a lower opportunity cost to his leisure hours and, therefore, work for less (Carroll and Ihnen 1967, p.869). Other items, however, such as the working environment, will remain unquantifiable. We could only qualify that the monetary value of the total pay package arrived at in this way represents an underestimate.

Data sources

Information on fringe benefits in general is abundant. But data on fringe benefits classified by the educational level of the recipient are very scanty.

The data sources can be classified into five distinct groups.

(a) Various monographs on fringe benefits like Moonman (1974), Reid and Robertson (1965), Burgess (1963) and Rubner (1962). The problem with these monographs, however, is that they give a too aggregate picture of fringes for our purposes and the fringe benefits are classified by industrial or occupational categories. On the other hand this source of data is useful in assessing the importance of the total fringes in the pay package and their overtime trend. Moreover, if one establishes an occupation into education translation, some light can be thrown on our problem.

(b) A number of Government publications provide the same kind of information on a regular basis. The most useful appear to be the U.S. Bureau of Labour Statistics surveys of employee compensation, the U.S. Chamber of Commerce biennial survey of fringe benefits and the U.K. Department of Employment "New Earnings Survey". The problem with this type of source of data, however, is that although the industrial dimension is covered in great detail the occupational dimension is either absent or treated at a very aggregate level.

(c) Evidence on fringe benefits by occupation can be found by scanning the pages of specialised journals like the Harvard Business Review and the Monthly Labour Review. The problem with the former is that it deals almost exclusively with top executive pay and, therefore, the educational dimension is absent. The problem with the latter is that it provides extensive coverage on the industrial, but not occupational dimension of fringe benefits.

(d) Further evidence on fringe benefits by educational level can be extracted from ad hoc tabulations encountered in the literature. This is when an author's main concern was not the study of fringe benefits but in the process of analysing earnings he produced a useful tabulation for our purposes (e.g. Carroll and Ihnen 1967).

(e) Finally, the civil service pay scales can be used as a basis for computing fringe benefits by educational level. But the reader should be warned that although civil servants' fringe benefits represent a private gain, one is not certain whether this reflects a social gain as well. The reason is that Government does not obey profit maximising principles and therefore a divergence may exist between private and social returns computed on the basis of earnings of public sector employees.

In what follows we first assess the importance of fringe benefits in the total employee compensation. Then we proceed to alternative classifications of fringe benefits, i.e. by occupation, economic sector, sex and, finally, education. The reason for the alternative classifications is that direct evidence on fringe benefits by educational level is practically non-existant. But the extent to which certain occupations are more education-intensive than others provides indirect evidence on the educational dimension of fringe benefits.

The evidence

Let us start by presenting some information on the significance of fringe benefits as a whole relative to base money wages. Tables 6.1 and 6.2 show that this is not a negligible percentage. In some countries the proportion of fringes relative to money wages can be as high as 100 per cent. And this information relates to the late fifties. Table 6.3 shows that the importance of fringes increase over time. Whereas a limited[1] category of benefits represented 1.4 per cent of the total compensation in 1929, it now represents nearly 10 per cent. Finally, Table 6.4 shows the composition of fringe benefits at two points in time in the United States. Pension plans and paid holidays account for the majority of supplementary expenses.

In terms of absolute magnitude Gordon and Le Bleu (1970) report that U.S. companies spent 100 billion dollars in 1967 on employee benefits which is about one-fifth of the country's Gross National Product. And in terms of relative magnitudes employee benefits expanded more than twice as fast as wages and salaries. The 1929-1967 average annual rates of growth are as follows:

Wages and salaries	3.9%
Fringe benefits	9.6%

In the light of the above evidence we conclude that the inclusion of fringe benefits is a must in any analysis of earnings. Our problem, however, is to classify them by educational level.

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[1] As specified in the footnote of Table 6.3

Table 6.1

Fringes as a percentage of money wages by country

Country	Percentage of wages
U.S.A.	23
U.K.	15
Austria	50
Belgium	31
Canada	22
France	52
Denmark	17
Germany	45
Greece	43
Israel	39
Italy	72
Netherlands	30
Sweden	15
Turkey	43

Source: Rubner (1962), p.231

Table 6.2

Supplementary labour costs as percentage of earnings by country

Country	Percentage of supplementary labour costs
Belgium	48.8
France	80.0
West Germany	61.8
Italy	99.3
Netherlands	50.7
U.K.	30.0

Source: Reid (1965b), p.119

Note: Data refer to the chemical industry in 1961

Table 6.3

Percentage Importance of selected fringe benefits in the U.S.A. 1929-1969

Year	Fringe benefits [a.] as a percentage of total compensation
1929	1.4
1930-34	1.7
1935-39	3.4
1940-44	3.8
1945-49	4.6
1950-54	5.3
1955-59	6.7
1960-64	8.4
1965-69	9.5

Source: Bauman (1970), p.19

a. Includes social security, unemployment, life and health insurance as well as pensions. Paid leave and bonuses are excluded.

Table 6.4

Fringe benefit components as a percentage of total payroll, U.S.A.

Item	1947	1961
Legally requirement payments	2.9	4.5
Pension plans	4.1	8.7
Paid rest periods (lunch, travel etc.)	1.6	2.5
Paid holidays and sick leave	4.8	8.8
Profit sharing and bonuses	1.2	1.9
Percentage of total payroll	14.6	26.4

Source: U.S. Chamber of Commerce (1962), p.28.

Alternative dimensions of fringes

In the absence of direct data on fringe benefits by education we have to look at alternative dimensions of fringe benefits such as occupation and economic sector. To the extent that the labour force in certain occupations or sectors has a higher level of educational attainment than others, such tabulations can yield indirect evidence on our problem.

Since most of the data examined in this paper refer to the United States and Great Britain we present below some evidence that this is, in fact, the case. As Tables 6.6 and 6.7 indicate, there exists a considerable spread of educational attainment (in terms of the average years of school completed) between occupational and industrial sector employee groups. In Great Britain the difference between the highest (professionals) and lowest (miners) occupations is 3.9 years of schooling. The corresponding difference in the U.S. happens to be identical, although the average level of schooling of the U.S. labour force is higher than the U.K.'s. Finally, Table 6.7 shows that certain industries like commerce and services are more education intensive than others (like construction and agriculture).

Table 6.5

Education by occupation, U.K. 1961

Occupation	Average years of schooling
Professional, technical and related workers	12.4
Administrative, executive and managerial workers	10.7
Clerical workers	10.2
Sales workers	9.4
Craftsmen, production and process workers	6.3
Miners	8.5

Source: O.E.C.D. (1969), p.45

Note: Based on the following assumptions on the years of schooling corresponding to terminal education ages:

Terminal education age	Years of schooling
Less than 15	8
15	10
16	11
17-19	13
Over 20	16

Table 6.6

Education by occupation, U.S.A., 1960

Occupation	Average years of schooling
Professional, technical and related workers	14.6
Administrators, executive and managerial workers	12.5
Clerical workers	12.0
Sales workers	11.7
Craftsmen, production-process workers	10.7
Miners	10.5

Source: O.E.C.D. (1969), p.112

Note: Based on the following assumptions on the years of schooling corresponding to O.E.C.D.'s classifications:

Less than 4 years of high school = 10
4 years of high = 12
1-3 years of college = 14
4 years of college = 16
5 years or more of college = 17

Table 6.7

Education by economic sector, U.S.A., 1960

Sector	Average educational level of the labour force (in years)
Agriculture	8.1
Mining	9.4
Manufacturing	10.0
Construction	7.6
Electricity	10.3
Commerce	10.9
Services	11.3

Source: Based on O.E.C.D. (1969), p.114.

Occupation

Table 6.8 presents evidence on the differential fringe benefits between office and non-office employees in the United States. Office employees not only have a higher level of compensation than non-office employees, but they also receive more vacation and holidays, retirement plans and bonuses. Although the exact educational content of the two kinds of employees cannot be specified, fringe benefits are highly related to education.

Table 6.8

Fringe benefits for office vs. non-office employees, U.S.A., 1968

Fringe item	Fringe benefits as percentage of total compensation	
	Office employees	Non-office employees
Vacations and holidays	6.1	4.8
Retirement programmes	6.3	5.9
Health programmes	3.3	4.1
Bonuses	1.8	.5
Total compensation (Dollars per hour)	4.62	3.20

Source: U.S. Department of Labour (1971), p.14.

Table 6.9 presents similar evidence for the U.K. The occupational levels distinguished are now operatives versus clerical workers. The latter are clearly treated better in almost every respect. They receive more holidays, they work less and enjoy such fringes as not having to clock on, and no pay deductions for being late.

Table 6.9

Fringe benefits by occupation, U.K.

(Percentage of establishments in which different conditions apply)

Condition	Operatives	Clerical workers
Holidays: 15 days +	38	74
Normal working time 40 + hours/week	97	9
Sick pay employer's scheme	57	98
Pension employer's scheme	67	90
Personal time off with pay	29	83
Pay deductions for lateness	90	8
No clocking on	2	48

Source: Wedderburn (1972), p.177

Table 6.10 refers also to the U.K. and gives an alternative occupational contrast between manual and non-manual workers. According to the most recent earnings survey of the U.K. Department of Employment, basic pay represents only 71 per cent of manual workers' pay. The rest has to be made up by overtime or payment by results. But more educated non-manual workers' pay consists mostly (9 per cent) of their basic pay. Therefore, non-manual workers do not have to work as hard to achieve an even higher level of total earnings (£48 versus £38 per week).

Table 6.10

Composition of the earnings of manual and non-manual men, U.K., 1973

Earnings component	Manual	Non-manual
Basic pay	71.5%	93.8%
Payment by results	9.6	2.8
Overtime	16.3	3.0
Shift and premium pay	2.6	.4
	100%	100%
Gross weekly pay	£38.1	£48.1

Source: U.K. Department of Employment (1973), Tables 67 and 68.

An alternative occupational distinction that relates to education is between "works" and "staff" employees. Reid (1965a p.42) presents the following evidence on supplementary labour costs for the two kinds of employees: works 11.8 per cent and staff 18.1 per cent of total remuneration.

Moonman (1973) reports fringe benefits by using a further alternative occupational classification: that between hourly, weekly and monthly paid employees. As shown in Table 6.11 weekly and monthly paid employees (presumably with higher levels of educational attainment) enjoy more paid holidays. Moreover, they receive more benefits in terms of pension and life insurance plans (Table 6.12). According to Moonman, the overall cost of fringe benefits amount to 21 per cent of the payroll or £325 per employee. However, it should be mentioned that her sample is biased towards large companies.

Table 6.11

Annual holidays and cost by type of employee, U.K.

Employee	Average number of holidays per year (in days)	Cost of annual holidays as per cent of payroll
Hourly paid	15.4	6.1
Weekly or monthly paid	16.3	7.7
Senior executive	19.1	8.5

Source: Based on Moonman (1973), pp.17-18.

Table 6.12

Percentage of companies providing pension and life assurance by type of employee

Employee	Percentage of companies
Hourly paid	82.5
Weekly paid	92.5
Monthly paid and Senior Management	100.0

Source: Moonman (1973), p.52.

Moving up the occupational ladder, Moonman cites evidence that the cost of fringe benefits to executive in the U.K. is £770 per head, per year. This figure covers meals, bonuses, pensions and cars.

Lewellen (1968) studied the top five executives in the 50 largest U.S. manufacturing corporations. His analysis revealed that the basic salary and bonus are only one third of the executive's total pay package (Table 6.13).

Table 6.13

Average after-tax income of top executives, U.S.1955-63

Compensation	$	%
Salary + bonus	80,830	38
Pension benefits	31,290	15
Deferred compensation and profit sharing	23,640	11
Stock options	74,900	36
Total	210,660	100

Source: Lewellen (1968).

The Associated Industrial Consultants publish data on the fringe benefits of executives in the U.K. Table 6.14 shows how these benefits have grown within five years. The greatest shifts have been towards life assurance and private medical treatment plans.

Table 6.14

Proportion of executives receiving fringe benefits, by item

Fringe item	1963	1968
Bonus	41.1	40.6
Company car	32.5	45.4
Subsidised lunches	40.5	79.3
Allowance for use of own car	3.9	27.3
Free life assurance	3.2	79.0
Insurance for private medical treatment	2.2	26.4

Source: Associated Industrial Consultants (1968), p.48.

Industrial

Turning now from an occupational to an industrial classification of fringes we observe that more education intensive sectors (like banks and finance) exhibit higher rates of fringe benefits. This statement is supported by the data published by the U.S. Chamber of Commerce (Table 6.15).

Table 6.15

Fringe benefits by industry group, U.S.A. 1961

Industry group	Fringe benefits as percentage of payroll
Manufacturing	23.6
Public utilities	25.6
Trade	22.2
Hotels	20.4
Banks and finance	33.5
Insurance	27.7

Source: U.S. Chamber of Commerce (1962), p.10.

In another study Gordon and LeBleu (1970) found an even greater spread of fringes between different economic sectors. The percentage of fringes ranged from 15 per cent in agriculture and services to 32 per cent in finance. What is more important for our purposes, however, is that the effect of labour unions on the amount of fringes was minimal. The impact of the stronger union (over non-unionsation) was an extra 3 per cent of the payroll spent for pension and hazard protection.

Sex

Another classification of fringe benefits that might reflect educational differences is by sex. Cohen (1971) reports the results of a 1968 University of Michigan Survey in which the median annual incomes of men were $8,200 and of women $4,500. As shown in Table 6.16 women also received lower fringe benefits. This finding is consistent with Rice (1966) who reports that lower paid workers receive less fringes than higher paid workers (both in absolute and percentage terms).

Table 6.16

Recipients of fringe benefits, by sex

(percentage)

Fringe item	Sex	
	Male	Female
Medical insurance	85.0	70.0
Life insurance	74.6	60.9
Retirement programme	72.3	57.2
Profit sharing	22.4	16.1
Stock options	21.2	13.2
Mean paid vacation days	11.6	9.0
Mean paid sick days allowance	21.8	13.3

Source: Cohen (1971), Table 1

Education

Carroll and Ihnen (1967) may be the only explicit source in the literature where some evidence is given on fringe benefits by educational level. The authors compared two groups of graduates, one with secondary school qualifications and another with 2 year post-secondary technical qualifications. The differential fringe benefits for the two groups of graduates appear in Table 6.17. The two extra years of education are associated with higher fringes in every respect. However, the educational levels compared are very limited and moreover the evidence is based on 87 observations.

Table 6.17

Fringe benefits of 2-year post secondary technical school graduates relative to high school graduates

Fringe item	Technical graduates	High school graduates
Required hours of work/week	40.5	43.2
Days of paid vacation/year	9.8	8.9
Days of paid holidays	6.7	5.5
Maximum paid sick leave/year	30	24
Employer's share of life insurance premium (%)	81	71
Employer-sponsored retirement programmes	37	27

Source: Carroll and Ihnen (1967), p.873.

Another source of data on fringe benefits is the Civil Service. This source has one advantage and one disadvantage. The advantage is that the public sector hires mostly on the basis of qualifications and therefore one can readily arrive at fringe benefits classified by educational level.

The disadvantage is that the public sector is not a profit maximiser and therefore fringes (or earnings in general) do not necessarily correspond to the value marginal product of labour. But note that this shortcoming is relevant only in assessing the social returns to education. The private returns remain valid even if they are based on non-profit maximising behaviour.

Table 6.18 presents evidence on the importance of one particular fringe item in the U.K. civil servants pay. The differential amount of annual holidays, when valued at the going salary rate,results to 5.8 per cent monetary benefit to non-qualified employees and to almost 10 per cent of the annual salary of highly qualified employees. As shown in the last column of Table 6.18 fringe benefits increase by educational level.

Table 6.18

Fringe benefits by educational level, U.K. civil servants

Occupation	Annual pay (£)	Typical qualifications	Annual leave (days)	Leave benefit as percentage of annual pay
Messenger	996	None	21	5.8
Clerical officer	1,489	O-level	24	6.6
Executive officer	2,159	A-level	28	7.7
Senior executive officer	3,638	A-level or degree	30	8.2
Assistant secretary	7,276	Degree	35	9.6

Source: Based on information supplied by the U.K. Civil Service Department.

The evidence presented in this table covers only one benefit, i.e. annual leave. But since all pension and retirement plans are based on the employee's salary, the same pattern of increased benefits by educational level appears when other fringes are examined. Moreover, less educated employees are required to work longer hours, as shown in Table 6.19 below.

Table 6.19

Minimum hours of attendance per week, U.K. civil servants

Occupation	Hours
Most occupations	41
Messengers and telephonists	42
Cleaners	43

Source: U.K. Civil Service Department

Turning to another country, Table 6.20 presents evidence on the allowances received by Iranian civil servants. The information is based on the computerised records of practically all public sector employees in Iran. The "allowances" includes all pay other than basic salary. The same pattern is detected in Iran as in the U.K. Namely more, educated employees enjoy higher percentage benefits above their basic pay.

But what is of special interest in the Iranian case is that two kinds of employees are distinguished: "permanent" and "contractual". The latter are hired on a non-tenure basis and, as evidenced by the differential allowances they get, represent the most difficult to hire specialists. In other words, the allowances system is used to bypass the rigid salary scale. Since contractual employees are hired in the competitive labour market, their differential allowances might better represent the true fringes by educational level. Of course one should look at differential allowances in a vertical sense in Table 6.20 as the absolute magnitude of them reflects outdated salary scales.

Table 6.20

Allowances as a percentage of basic pay by educational level, Iran Civil Servants

Educational level	Percentage allowances	
	Permanent employees	Contractual employees
Illiterate	6.1	22.2
Primary	12.7	24.6
Secondary	8.5	21.7
Bachelor's	27.0	98.4
Master's	27.8	136.7
Doctorate	26.5	120.3

Source: Psacharopoulos and Williams (1973), p.47.

Unemployment

Another item which could be included in a survey of fringe benefits by educational level is differential unemployment rates for graduates of various schools. If annual earnings take into account unemployment within the year, then there is no reason for an unemployment correction. But if earnings refer to theoretical monthly or annual rates of pay one should adjust them for unemployment. To the extent that more educated persons are less liable to unemployment this is a fringe benefit due to education.

Table 6.21 presents differential unemployment rates by educational level in the United States. There is a clear overall pattern that more educated labour is less subject to unemployment. In evaluating the monetary value of this fringe benefit, however, we face the earlier problem discussed in connection with valuing extra leisure time. Shall one use the going wage rate or maybe use a lower value as the unemployed benefit from some extra leisure? Any solution in this respect would be arbitrary.

Table 6.22 presents similar evidence from other countries. Although the overall pattern is the same as in the U.S., there exists a peak of the unemployment rate at the secondary school level. The reason is that the educational system in these countries is such that creates a bottleneck at that level. Namely, academic curricula form a pattern of aspirations among students to obtain university degree. When they graduate from the secondary level, however, there are not enough places for them to enter higher education. Therefore they remain unemployed.

Table 6.21

Unemployment rates by education, U.S.

(percentage)

Years of school completed	Unemployment rate
Less than 8 years	6.6
8 years	5.2
1-3 years high school	6.8
4 years high school	3.4
1-3 years college	3.1
4 years or more college	1.4

Source: Bancroft (1966), p.215

Note: Data refer to males.

Table 6.22

Unemployment rates by educational level

(percentage)

Country	Illiterates	Primary	Secondary	Higher
Colombia (Males)	11.5	15.3	14.9	13.2
Argentina	3.8	4.3	5.7	3.3
Venezuela	4.3	7.0	10.2	2.3
India	1.2	2.7	7.0	2.8
Ceylon	7.1[a]	n.a.	11.8	2.3
Malaya (Males)	10.4	19.5	30.9	15.5
Syria	4.3	n.a.	11.7[b]	4.4
Kenya	21.0	21.0[c]	13.0[d]	17.0[e]
Iran	10.0	8.1	13.0	2.6

Source: First seven countries from Turnham (1971), Table III.3.
Kenya from ILO (1972), p.59.
Iran from Psacharopoulos and Williams (1973), p.54.

Notes:
a. Includes primary grades 1-4.
b. Includes primary education.
c. 5-6 years of schooling.
d. 11-12 years of schooling.
e. 13-14 years of schooling.

The 100 per cent in all cases refers to the number of persons in the labour force with a given educational qualification.

How important are fringe benefits?

Any conclusions reached from our survey will necessarily have to be based on limited information. It should be remembered that data on earnings by educational level are still in limited supply around the world. Data on fringe benefits by educational level are even more scanty. Yet the different pieces of data presented earlier allow us to draw some conclusions on the issue we are concerned with.

In the first place, fringe benefits increase by the level of basic salary. Since more educated people earn higher salaries it is obvious that the higher the level of education the higher the level of fringe benefits. Therefore money wage differentials understate the true differential in compensation (Rice 1966). Table 6.23 presents some additional evidence in this respect from the U.K. Fringe benefits as a percentage of basic salary are three times as high for the upper relative to the lower income level.

Table 6.23

Fringe benefits by income level, U.K.

Basic salary (in £)	Fringes as per cent of basic salary
1,050	11.2
2,850	16.5
4,200	21.3
7,000+	31.1

Source: Lydall (1968), p.269.

Note: Figures relate only to managerial staff.

Moreover Cohen (1971) in an econometric analysis of the determinants of fringe benefits found high associations between the amount of fringes, male sex and professional occupations. These variables are of course positively correlated with the educational and income level of the recipient. Furthermore, Bailey and Schwenk (1972) based on a 1968 survey of compensation covering the entire U.S. private non-farm economy concluded that supplementary benefits on private retirement and insurance plans account for a larger proportion of compensation in large establishments with high rates of pay.

In order to put our findings in a nutshell we could utilise the concept of "dual labour" markets. Following Doeringer and Piore (1971, p.165) we could classify labour markets into "primary" and "secondary" ones. Jobs in the primary market exhibit high salaries, good working conditions, employment stability, chances of promotion and equity. Jobs in the secondary labour market have low wages, poor working conditions, high labour turnover, little chance of promotion and often arbitrary and capricious supervision. It should be obvious that the better educated are mainly employed in the primary labour market and therefore enjoy a whole string of fringe benefits relative to the less educated who are mainly employed in the secondary labour market.

Having established the existence of differential fringe benefits by educational level, the next question is what difference does it make for our purposes? To narrow down this question we will relate it to cost-benefit analysis in education that has traditionally neglected fringe benefits: how much does the resulting understatement of earnings differentials effect the rate of return to investment in education?

Out of the many items of fringe benefits let us select the most common to all employees, namely holidays. Carroll and Ihnen (1967) found that the differential holidays and leisure time, when valued at the going salary rate, are worth $446 per year to the technical school graduates. This differential had the effect of increasing the rate of return to technical school graduates from 16.5 to 20.1 per cent. In other words, when *only one item* of fringe benefits is taken into account it is sufficient to raise the traditional rate of return to investment in education by one fifth of its value.

This finding is of particular importance in the controversy regarding the various adjustments performed on a rate of return. As we have seen earlier in this book much of the controversy has centered around the ability adjustment, which, after all, has proved empirically insignificant. Now we are faced with an adjustment operating in the opposite direction (i.e. towards raising the rate of return) and which is of a value that cannot be easily neglected. The historical reason why researchers in this field failed thus far to take fringe benefits into account is simply lack of data.

The magnitude of the adjustment presented above is a *minimum value*. When fringes other than holidays and leisure times are taken into account this adjustment should be even higher.[1] Therefore, the explicit consideration of fringe benefits is a must in any future analysis of earnings.

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[1] It should be remembered, however, that monetary fringe benefits may not be directly related to education but in part to wage levels and the employer's desire to minimise quit rates. Differential unemployment may also be related to turnover and job search behaviour which is a function of job experience and therefore not directly related to schooling.

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Chapter 7

INTERNATIONAL EARNINGS PATTERNS[1]

Thus far in this book we have been dealing with methodological issues and earnings data interpretation problems. Most of the evidence cited referred to the United States, as this is the only country for which detailed earnings data are available. In this chapter we focus our attention to earnings data in the O.E.C.D. countries as a whole.

The chapter's function is twofold: firstly, it is informative in the sense of assembling a bibliography of the scanty evidence of earnings by education in O.E.C.D. countries. Secondly, it is analytical in the sense of attempting to examine aggregate relative earnings relationships within and between O.E.C.D. countries. The analysis, however, is highly aggregative. The reason is that earnings data in most countries (other than the U.S.) are not as refined as to permit more detailed international comparisons.

In what follows two types of relationships are examined. Firstly, cross-country by educational level and, secondly, time-series within countries. The last type of analysis is performed in three countries only, U.S.A., Japan and Italy as being the only ones for which earnings data exist at more than one point in time.

The Appendix to this chapter[2] presents the relative earnings by education and the sources on which the analysis in this chapter is based. The earnings data are as unadjusted as possible so as to avoid mixing different assumptions in comparing various countries.

International comparisons are notoriously known for non-comparability between classifications, definitions, number of years of schooling and the like.

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[1] Robin Shannon was responsible for the statistical material in this chapter and in the appendix.

[2] The Appendix is at the end of this volume.

Although within-country comparisons do not suffer from the comparability deficiencies, they present other problems. Data on earnings by education have become only recently available and researchers have been eager to use them without always questioning their validity.

Most of the analyses presented earlier in this book were of the within-country cross-sectional type (Chapters 3,4, 5 and 6) and therefore do not suffer, at least, from the international comparability problem. The analysis in this chapter, however, is of the international type and therefore the data might not be absolutely comparable. On the other hand, the international analysis is performed at a high level of aggregation which compensates to some extent for differences in classifications.

But several further particular data deficiencies should be mentioned at this point. The first one refers to disaggregation by sex. With the exception of a few countries, most available data on earnings by education are based on urban males only, or are simply not classified by sex. This is very unfortunate as the sex-education dimension of earnings can be used not only for assessing discrimination against females but also for studying the supply side of female labour force participation by educational level.

A second serious deficiency refers to the variance of earnings. Most statistics of earnings by education appear in the form of tabulations of average earnings. However, these averages mask the variance of earnings within a given group of graduates. If the variance of earnings were known, the returns to education and elasticity of substitution estimates would come in a range-form than as point-estimates. What is more important is that one could attach a rigorous measure of statistical significance to the results. This deficiency might disappear as analyses in the economics of education are now increasingly performed using individual data. However, these analyses are necessarily limited to special surveys containing a small number of observations and they refer almost exclusively to the United States.

Another limitation refers to the missing age factor. Earnings differentials are not constant throughout the lifetime of the individual. They vary according to his age or experience, let alone the particular career he follows.

But, it is hoped that the gradual improvement of statistics will soon permit more rigorous hypothesis testing concerning the role of education in society in a wider number of countries. This volume is a modest contribution towards this end.

Cross-country comparisons

Table 7.1 presents indexes of average earnings by education in ten O.E.C.D. countries, standardised to primary education = 100. Before attempting any interpretation of the data several remarks are in order. In the first place, the data are not absolutely comparable between countries. The non-comparability mainly consists of the differing meaning of the same "educational level" in different countries. The primary level represents 5 to 8 years of schooling in most countries, the secondary level 12 to 14 years and the higher level 16+ years. Even if the lengths of schooling were absolutely comparable, there remain important quality differences between schooling standards in different countries. Furthermore, the coverage and comprehensiveness of the various earnings sources varies enormously between countries.

In spite of these non-comparabilities some more or less clear patterns emerge from Table 7.1. Firstly, a higher level of schooling is associated with substantially higher incomes. e.g., with the exception of Belgium[1], completion of secondary education means, on the average, an extra 40 per cent gain in annual earnings.

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[1] The "odd" observation for Belgium might be due to the fact that the educational classification has been based on an occupational distribution of earnings. See Denison (1967).

Table 7.1

Index of Average annual earnings of labour by level of education in O.E.C.D. countries

Country	Year	Educational Level		
		Primary	Secondary	Higher
Belgium	1960	100	251	502
Canada	1961	100	144	263
France	1968	100	183	289
Greece	1960	100	139	220
Italy	1969	100	141	244
Japan	1968	100	117	161
Netherlands	1965	100	131	152
Norway	1966	100	140	213
U.S.A.	1967	100	129	200
U.K.	1967	100	140	225

Source: See Appendix.

Subject to the qualifications presented earlier in this book, this aggregate finding is consistent with marginal productivity theory. Namely, extra schooling renders the individual more productive and this is reflected in the remuneration he receives. Secondly, the higher the levels of education compared, the higher the marginal gain in terms of extra earnings. With the exclusion of Belgium, higher education is associated on the average with a 77 per cent gain over secondary education. This finding is again consistent with marginal productivity theory in the sense that higher education is more costly than secondary education and therefore the graduate commands an extra premium as a compensation for the extra cost. To put it in terms of the other side of the coin, the employer is willing to pay a relatively higher salary because he gets a relatively higher marginal product from the graduate (versus the secondary school leaver).

Looking now across countries, we discern a third pattern which is not as clear as the previous two. Namely, richer countries within the O.E.C.D. group show lower higher/primary relative earnings. This pattern becomes clearer when providing a control group of countries at substantially lower levels of development than the O.E.C.D. group of countries (see Table 7.2). Whereas in the O.E.C.D. countries higher education is associated with an approximate 200 per gain over primary, the corresponding gain in poorer countries is more than sixfold.[1]

This finding is again consistent with marginal productivity theory. The level of economic development is a surrogate for a set of other characteristics connected with the market for educated labour and the output of schools. Although countries differ in many other respects, high income countries have high proportions of labour with university qualifications and there is usually no restriction of entry into institutions of higher education. The opposite holds in developing countries where stocks of highly educated labour are low and there exists restriction of university places. This set of differential characteristics might be responsible for the observed narrower earnings differentials by education in advanced countries and wider differentials in less advanced countries.

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[1] For a similar finding in comparing relative wages in Bombay City and the United States, see Kothari (1970).

Table 7.2

Relative Earnings in O.E.C.D. Countries and in lower income countries

Country group	Educational level		
	Primary	Secondary	Higher
O.E.C.D.	100	140	219
Other	100	239	639

Source: "O.E.C.D. countries" from Table 7.1, excluding the observation for Belgium. "Other countries" are Malaysia, The Philippines, Ghana, South Korea, Kenya, Uganda, Nigeria and India, from Psacharopoulos (1973a), p.132.

Comparisons over time

Time series evidence on earnings by education exist only in the U.S., and Japan and, to a limited extent, in Italy. For the purposes of comparisons over time we will concentrate on the higher education differential. Table 7.3 shows the earnings differential in index form in three countries. The general pattern is that the higher education differential narrows over time.

Subject to the qualifications presented earlier, this observation is also consistent with marginal productivity theory. The time span covered by the three country cases corresponds to the period of the most rapid expansion of higher education relative to the other levels. For example, the percentage of those with higher education in Japan has more than doubled between 1950 and 1968, and almost doubled in the U.S. between 1952 and 1972.[1]

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[1] See tables A.8 and A.13 in the Appendix.

Table 7.3

Index of changes over time in the higher education earnings differential in three countries

Japan		U.S.		Italy	
Year	Index	Year	Index	Year	Index
1954	100	1949	100	1967	100
1964	98	1959	100	1968	99
1969	93	1971	85	1969	92

Source: Japan from Table A.7.
U.S. from Table A.12.
Italy from Table A.5.

Note: The higher educational earnings differential is relative to the secondary level in Japan and Italy and to 8 years of schooling in the U.S.

The constancy of the U.S. differential between 1959 and 1969 has puzzled economists for a long time. A host of explanations has been given in terms of capital-skill complementarities, high income elasticities of demand for skill-intensive products and unskilled labour-saving technical change.[1]

Although differentials have been narrowing, the decline is far from dramatic. The small change of earnings differentials relative to the high increases of the supply of educated persons has another economic interpretation.

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[1] See Bowman and Anderson (1974), Griliches (1969), Griliches (1970), Welch (1970) and Bowman (1971).

It means that there exists flexibility in production and various mixes of qualified manpower can be absorbed without drastically affecting relative wages. To put it in other words, the slow narrowing of the earnings differential indicates a high elasticity of substitution between educated labour. Empirical estimates of the magnitude of this elasticity indicate that, although not equal to infinity, it is high enough to warrant the use of cost-benefit analysis in educational planning.[1] But a high elasticity of substitution, although important, it is not sufficient to generate the observed slow, if any, narrowing of earnings differentials. In order to explain this phenomenon one must also emphasise the role of growing demand for educated labour in the period under consideration.

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[1] The elasticity of substitution is found to be statistically higher than 1 and less than infinity. See Dougherty (1972) for substitution evidence in the U.S. and Psacharopoulos (1973b) for a review of substitution evidence in a number of countries.

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Chapter 8

CONCLUSION

Thus far we have treated a variety of topics related to earnings and education. In this final chapter we first try to pull the threads together and assess what we have learned. This, inevitably, leads to the realisation of major knowledge and data gaps to which the second part of this chapter is devoted.

The reader is reminded that the choice of topics treated in this volume reflects the present state of our knowledge in the economics of education. We know, for instance, that the returns to investment in education are generally "high", particularly at the lower levels of schooling and in less advanced countries. We know that the private returns are higher than the social returns, and we know that the degree of substitution between educated labour is on the high side. Moreover, we also know that education has something to do with the way income is distributed in our society.

Therefore, we have made an effort here to move beyond what we already seem to have knowledge of and concentrate on some topics about which we are doubtful. These topics were the role of differential ability in the earnings determining process, the importance of schooling quality versus years of schooling completed, the existence or not of monopoly incomes due to restrictions of entry and, lastly, the importance of omission of fringe benefits in usual wage statistics. Since much of the evidence on which our knowledge is based comes from the United States, another function of this book has been bibliographical in the sense of documenting earnings by education data sources in other O.E.C.D. countries. But we have also moved beyond the bibliographical aspect and present some aggregate statistics and analysis of earnings by education in O.E.C.D. countries.

Synopsis of findings

Subject to the qualifications discussed throughout this volume, the review of evidence supports the following five propositions:

a. The importance of differential student ability is not as important as intuitively thought in determining earnings differentials. Whereas in the early sixties the proportion of the earnings differential due to education was *assumed* to be equal to .6, our *empirical* review indicates that a more plausible value is .9. This means that the influence of ability on earnings variations by level of education is rather small.

b. Our review indicates that the quality of education is very important in determining earnings. Early work in the economics of education neglected variations in school quality which now appear to have a significant impact on earnings. In fact, the recent evidence indicates that expenditures on improving the quality of schools might have a higher yield than expenditures on providing extra years of schooling.

c. It appears from our analysis, that monopoly elements in earned income by level of education are negligible. The classical case of alleged monopoly income because of restrictions to entry is that medical doctors have high earnings relative to other occupations. However, the greatest part of these earnings represents compensation for higher training costs or longer hours worked. After adjustment for these factors, the yield to entry into "high-pay occupations" becomes similar to that in other occupations. However, the possibility cannot be excluded that our results are biased in view of probable under-reporting of professional earnings.

d. Our review of fringe benefits revealed that earnings differentials are seriously under-estimated, unless remuneration other than basic salary is taken into account. It is very unfortunate that past research has almost universally neglected fringe benefits in analysing earnings by education due, of course, to lack of data.

e. The relative earnings by education in O.E.C.D. countries presented in this volume have been used to derive cross-sectional and time-series relationships. When the cross-section refers to different levels of education, a pattern emerges of increasing earnings differentials by ascending educational level. When the cross-section refers to various countries, differentials narrow as a function of development or the proportion of qualified persons in the labour force.

Finally, the time-series analysis indicates a clear narrowing of earnings differentials within the countries where data on earnings are available at more than one point in time. These findings are consistent with the "economic" spirit of this volume, namely simple supply and demand conditions can generate the observed patterns of earnings differentials by level of education in O.E.C.D. and other countries.

A post-script on further research

It is relatively easy at the end of a volume like this to draw a long list of items one would like to see researched. For example, we could argue for the development of a better "ability" measure or a better index for assessing the "quality" of different schools. In what follows I try to move a little beyond what has already been discussed and suggest a limited number of topics that, in my opinion, should receive increased attention in the years to come.

Starting from the issues again, we noted earlier that we wish to increase our knowledge on the role of education in society. In this volume we limited ourselves to the economic role of education among the many other functions of schooling in our society. One of the reasons why we wish to know more about the economic role of education is in implementing the right kind of policy. For example, on efficiency grounds one such policy might be to expand the X level of education relative to level Y, while on equity grounds a different policy prescription might have resulted. The essential analytical ingredient for arriving at such policy decisions is the earnings of labour classified by educational level, and this volume was devoted to some problems related to the interpretation of such data. Of course, no one would claim that further problems do not exist, and many would keep asking how good observed earnings data are in the first place.

This is a question that has been asked over and over again, and to which no definitive answer can be given. The answer depends on what we want the data for, and also on their source. If the purpose of the analysis is, for example, the study of the reaction of individuals to signals in the labour market, the question of how good or bad the observed data are becomes trivial. The reason is that individuals respond to private incentives which are measured by observed market wages. The situation is different if one wants to estimate social efficiency parameters. Then the validity of the data becomes crucial. For if observed wages do not approximate the social marginal product of labour, then all the analyses described earlier in this volume become pointless. This problem has been "solved" by the usual "marginal productivity assumption", namely that observed before tax wages represent the social marginal product of labour.

Improvements over this assumption (that many might consider as naive) consist of either using econometric techniques for the derivation of the shadow price of labour or by limiting the analysis to labour markets where we have reason to believe that labour is competitively hired. The econometric techniques have the disadvantage of the problems associated with production functions. Namely, it is very difficult to find disaggregated data of labour by educational level, specify and fit an aggregate production function. In view of these difficulties my first suggestion is to increasingly:

a. Study earnings in competitive labour markets

It might be better (if not simpler) to concentrate future analyses of the type described thus far in this volume (and below) on data raised in competitive labour markets. Although this shifts the problem as to what is a really competitive market, data from public sector employment, aggregate Census data and sectors with strong union influences should be excluded.

Understandably, the first analyses in the economics of education were based on whatever wage data were available. But it is my opinion that we now can afford to be more selective. Moreover, the earnings structure in a competitive labour market will serve as an important "control group" for the study of earnings structures in less competitive markets, like the civil service.

b. Concentrate on starting wages

Much of the analyses presented in this volume dealt with the average wage of one individual over his lifetime. This is an awkward concept indeed. Earnings do change over the life cycle and therefore different results are obtained by taking into account the true age-earnings profile of the individual. The way in which age-earnings profiles have mostly been constructed thus far is by means of cross-sectional earnings data of people at different ages. This, of course, is not satisfactory in itself as there is no reason why the current cross-sectional pattern should extrapolate into the future. Although longitudinal age-earnings profiles have also appeared in the literature, they also suffer from the same defect: they are valid for a historical analysis of earnings. But why should history repeat itself into the future?

The answer to this is to concentrate the analysis on starting salaries by educational level. The reason is that starting salaries are less subject to social custom arguments regarding the process of wage determination. Moreover, they can serve as a parameter on which marginal decisions on education can be based. Relative starting salaries by educational level show the relative weight employers put on different levels of education. Moreover, trends of changes in relative salaries can be very useful in assessing changes in the labour market for recent graduates. Note that average salaries by educational level (or cross-sectional age-earnings profiles, or even longitudinal ones) are already contaminated by the experience dimension and, therefore, cannot be used as a basis for formal educational policy.

Starting salaries are also useful in the study of career patterns. For, assume we have established the earnings profile of a given career using conventional cross-sectional or longitudinal data. Then recent starting salaries of persons entering this career would provide the shift factor of the whole lifetime profile.

c. Disaggregate the analysis of earnings by subject

Much of what we know on the returns to education refers to the educational level as the unit of analysis. So we know, for example, that the lower educational levels are more profitable (socially and privately) than the higher levels. However, evidence is very scanty on the returns to education within levels disaggregated by subject. For example, what are the returns to different subjects of secondary technical education? What are the returns to particular fields of higher education?

Answers to questions like these could also be used as tests of the screening hypothesis. If persons with, say, a first degree in chemistry working in the chemical industry earn more than persons with the same degree working, for some reason, in another industry, this observation runs against the screening hypothesis. To put it another way, education of the right kind has a value when used in the right place relative to another place. If employers were simply using the first degree as a screening device, the chemistry subject would not be related to earnings.

d. Study individual private choices

Maybe too much attention has been paid to the estimation of social efficiency measures in education and little effort to understanding the response of individuals to signals in the labour market. And, in fact, most of the objections in this field relate to the social dimension of education. But the majority of countries, particularly the advanced ones, base the expansion of their educational system on social demand. Namely, regardless of efficiency considerations they provide the necessary places to those who wish to study at a given educational level and have the qualifications to do so. Now the institution of, say, a new pay scale system of civil servants by level of education will have an impact on the demand for school places. In order to anticipate this demand and to avoid bottlenecks it is important to know the individual response to changes in the private returns to education. Another reason why the assessment of private (read, social) demand is important is that countries increasingly shift part of the cost of education to the individual, particularly at the higher levels of education. Therefore, it becomes an interesting question whether the educational explosion of the last decade will continue in the future.

e. Elaborate the determinants of earnings

This is an issue dealt with in patches above and to which we now return. Is it years of schooling, ability, school quality or what that determines earnings? What is the relative numerical importance of each factor? Are these really "determinants" of earnings or simply associations? How can one disentangle the role of ability from that of the socioeconomic background? To what extent do earnings-determining factors interact?

Although we do have some knowledge on the above issues, this is a subject that should receive increased research attention in the years to come. The reason for this is that answers to the above questions have a wide area of policy implications. For example, a kind of policy might be instituted that would be more effective than others in altering income distribution.

f. Study post-school investments

Much of what has been described as attributable to schooling in this volume, must of course be contaminated with returns to post-school investments. Furthermore, parental investments in pre-school children are part of the human capital embodied in the individual. One way of distinguishing between school and other human capital investments is by conducting the earnings analysis at Mincer's "overtaking age".

g. Improve European earnings statistics

Much of the research results reported in this volume refer to the United States. Chapter 7 has shown that although earnings statistics do exist in European countries, they are not yet detailed enough to repeat the American analysis and compare results. Moreover, new insights might develop by studying individual earnings by education in a socioeconomic context different from the U.S.

Therefore, let us close this volume by a plea for increased availability and improved quality of European earnings by education statistics.

APPENDIX

COUNTRY TABLES AND DATA SOURCES

This appendix to chapter 7, above, presents summary tabulations of earnings by education in O.E.C.D. countries and also discusses the sources of data. The following sixteen countries are covered:

- Australia
- Belgium
- Canada
- Denmark
- France
- Greece
- Italy
- Japan
- The Netherlands
- New Zealand
- Norway
- Spain
- Sweden
- Turkey
- United Kingdom
- United States

There already exist three studies containing detailed bibliographies on earnings sources in different countries. These are Denison (1967), Lydall (1968) and Psacharopoulos (1973). This appendix updates the above sources and also gives summary tabulations of relative earnings by education whenever possible.

Australia

Blandy and Goldsworthy (1973) discuss earnings data from three sources in Australia. However, the raw data do not appear in this document.

Belgium

Frank and Associates (1964) contains earnings by occupation rather than education in 1960. The occupation to education translation yields earnings by education as in Table A.1.

Age-earnings profiles by education in Belgium are found in Desaeyere (1969). However, the earnings data are based on a number of surveys among professional workers only (the most detailed being for economists who represent 10 per cent of the sample).

Table A.1

Earnings Differentials in Belgium, 1960

Occupational Group	Typical years of school completed	Mean income (Group I = 100)
I	7-8	100
II	9	130
III	12	251
IV	14-16	349
V	16 or more	502

Source: Based on Frank and Associates (1964).

Canada

Age earnings profiles by education exist in Canada and are based on the 1961 Census. (See Canada Dominion Bureau of Statistics 1963). These data have been analysed by Podoluk (1965) on which Table A.2 is based. For further analyses of incomes in Canada see Bertram (1966), Wilkinson (1966) and Denison (1967).

Table A.2

Average Earnings by Age and Selected Level of Schooling: Canada, Males, 1961

(dollars)

Age	Schooling		
	Elementary 5-8 years	Secondary 4-5 years	University degree
19	1550	1600	
20	1800	2000	
21	2000	2500	
22	2250	2850	
23	2425	3100	3550
24	2550	3400	4100
25-34	3418	4760	6909
35-44	3807	5779	9966
45-54	3844	6130	10821
55-64	3701	5944	10609

Source: Podoluk (1965), p.69

Denmark

There exist several sources of earnings data for Denmark. However, the form in which the data are published do not allow indexes by level of schooling to be derived. Steenstrup (1968) analyses earnings based on a special 1966 survey. Hansen (1966) deals with the returns to education in Denmark but does not reproduce the age-earnings profiles used. Finally Bjerke (1964) uses a skill rather than educational classification of earnings.

France

The basic sources of earnings by education in France are Jallade (1972) and Levy-Garboua (1972) and (1973). The former analyses three special samples of workers in 21 private firms and the French railways. Table A.3 shows average earnings by level of schooling before and after adjustment for age and experience.

Table A.3

Mean Monthly Wages by Level of Schooling in France: private Firms and State Railways (SNCF), 1968

(Males)

Years of Schooling	Educational Level at the time of hiring	Private Firms			State Railways (SNCF)		
		Not Adjusted (1)	Adjusted (2)	Index (3)	Not Adjusted (4)	Adjusted (5)	Index (6)
7	Primary dropout	1388	1110	84	119[illegible]	1383	87
8	Primary	1388	1318	100	1694	1586	100
9	Lower secondary	1235	1897	144	1924	1892	119
10	Technical secondary (short)	1632	1686	128	1734	1776	112
11	Technical secondary (long)	2157	2239	170	2256	2069	130
11	BAC - 1st part	2167	2369	180	2256	2149	135
12	BAC - technical	2443	2666	202	2477	2416	152
12	BAC - general	3023	3043	231	2477	2362	149
13-15	University dropout	3023	3043	231	2477	2362	149
	University	3420	3650	277	2865	2612	165
15	Graduate study	4415	4449	338	2865	2953	189
17	"Grandes Ecoles"	5235	5136	390	3046	2953	189

Source: Based on Jallade (1972), Table 1, p.45

Note: Indexes in columns 3 and 6 based on columns 2 and 5, respectively. Index base is the average salary of those with 8 years of schooling.

Germany

Age-earnings profiles in Germany were analysed by Schmidt and Baumgarten (1967). However, it is not possible from the published data to construct a comparative table for the purposes of the appendix.

Greece

There exists a single source of earnings by education in Greece (Leibenstein 1967). This was utilised by Bowles (1969), Bowles (1971), Psacharopoulos (1970) and Psacharopoulos (1973). Table A.4 presents indexes of relative earnings based on this source.

Table A.4

Index of Average Annual Earnings of Males in the Labour Force by Educational Level, Greece 1960

Educational level	Index
Primary	100
Secondary	139
Higher	220

Source: Psacharopoulos (1973), p.132.

Italy

The sole source of earnings by education in Italy is Bank of Italy (1971) and (1972). Table A.5 presents indexes of earnings by different levels of schooling at three points in time.

Table A.5

Relative Earnings by Education, Italy

Educational level	Year		
	1967	1968	1969
Illiterate	31	29	32
Literate	40	42	43
Primary	70	68	69
Lower Secondary	100	100	100
Upper Secondary	128	139	141
University degree	264	261	244

Source: Bank of Italy (1971) and (1972), Table 10.

Japan

Japan is relatively rich in earnings by education data. Furthermore, time-series evidence on earnings exists. The basic sources are Japan Ministry of Labour (various years), Japan Ministry of Labour Statistics and Information Department (1972) and Japan Office of the Prime Minister (annual). Analyses of Japanese earnings data are found in Stoikov (1973) Bowman (1970), Danielsen and Okachi (1971), Watanabe (1972) and Kanamori (1971 and 1972).

Table A.6 shows relative earnings by education in Japan in 1968, whereas Table A.7 shows the over time pattern of relative earnings. Table A.8 presents the over time distribution of educational attainment in Japan for the purpose of time series analysis of earnings.

Table A.6

Indexes of Earnings by Education, Japan 1968

Years of schooling	Index
8	100
9-11	-
12	117
13-15	136
Over 16	161

Source: Kanamori (1971), Table 4.4, page 55.

Table A.7

Relative Wages of Males aged over 25 by Education, Japan, 1954-1969

Year	Elementary	High School	Junior College	University
1954	83	100	122	140
1958	83	100	121	132
1961	86	100	123	140
1964	86	100	116	138
1965	86	100	119	134
1969	93	100	114	131

Source: Watanabe (1972), Table 5, page 39.

Note: The educational levels correspond to 9, 12, 14 and 16 or more years of formal education, respectively.

Table A.8

Distribution of Educational Attainment in Japan, 1895-1968

(percentage)

Year	None	Elementary	Secondary	Higher
1895	84.1	15.6	0.2	0.1
1905	52.3	41.6	0.9	0.2
1925	20.0	24.3	4.9	0.8
1935	7.1	82.1	9.2	1.6
1950	2.3	78.5	15.8	3.4
1960	0.5	63.9	30.1	5.5
1968	0.4	59.2	32.4	8.0

Source: 1895-1960: Lydall (1968), Table 7-10, p.228
1968: Japan Ministry of Education (1970),
Basic table 30, p.215.

Netherlands

Data on earnings by education in the Netherlands are found in Netherlands Central Bureau of Statistics (1964, 1967 and 1968). The last source of data has been analysed by Wolff and Ruiter (1968). Table A.9 gives earnings differentials by level of education in the Netherlands in 1965.

New Zealand

Earnings by education in New Zealand are analysed in Ogilvy (1970). However, we are unable to present here a comparative table of indexes for this country.

Table A.9

Indexes of Median Earnings Differentials of Males by Educational Level, Netherlands 1965

Educational level	Average years of education	Index
Elementary	7.0	100
Lower secondary	10.5	109
Middle	13.7	131
Semi-higher	16.0	152
Higher	20.0	267

Source: Netherlands Central Bureau of Statistics (1967)
Tables 1, 2 and 3.

Norway

The sole source of earnings by education in Norway is Aarrestaad (1969). These data have been later analysed in Aarrestaad (1972). Table A.10 presents an index of relative earnings by education based on Psacharopoulos (1973).

Spain

Earnings by education in Spain exist in Grifoll Guasch (1969). However, the data are based on a small sample survey in Barcelona only and no comparative index is presented in this appendix.

Sweden

There exist three sources of earnings by education (or occupation) in Sweden: Magnusson (1970), Magnusson and Tychsen (1971) and Klevmarken (1972). However, no comparative table can be readily constructed from these sources.

Turkey

Krueger (1972) analyses earnings by education in Turkey. However, only lifetime earnings are given and therefore cannot be used for our purposes.

Table A.10

Index of income classified by years of schooling, Norway, 1966

Years of schooling	Index
8	100
12	240
16	213

Source: Based on Psacharopoulos (1973).

United Kingdom

There exist several sources of earnings by education in the U.K. These are Blaug (1965), H.M.S.O. (1971), Morris and Ziderman (1971), Layard et.al. (1971) and H.M.S.O. (1973). The problem with U.K. earnings data, however, is that they are usually classified by terminal education age rather than the true level of schooling completed. Table A.11 shows an index of earnings by education in the U.K. as found in Psacharopoulos (1973).

Table A.11

Relative Earnings by Education, U.K. 1967

Educational level	Index
Primary	100
Secondary	140
Higher	225

Source: Psacharopoulos (1973), p.185.

United States

Earnings by education data are abundant in the U.S. The sources are the 1940, 1950, 1960 and 1970 Censuses as well as a host of special surveys. Classic analyses of earnings by education in the U.S. are found in Miller (1960), Becker (1964), Hanoch (1967) and Eckaus (1973). Table A.13 gives the time series distribution of educational attainment in the U.S.A.

Table A.12

Indexes of income or earnings by years of school completed U.S.A. 1949, 1959 and 1971

Years of school completed	1949	1959	1971
0	50	51	82
1-4	65	61	
5-7	80	83	
8	100	100	100
9-11	115	116	113
12	140	135	129
13-15	165	165	150
16	n.a.	216	n.a.
16 or more	235	235	200
17 or more	n.a.	258	n.a.

Source: 1949 and 1959 from Denison (1967), p.374;
1971 from U.S. Bureau of the Census (1972), p.112.

Table A.13

Educational Attainment of Workers age 18 or over, selected years, U.S. 1952-1972. (Percentage of civilian labour force).

Years of school completed and date	Both sexes	Male	Female
Elementary: 8 years or less			
October 1952	37.9	41.2	31.0
March 1962	27.0	29.6	21.8
March 1972 a.	14.9	17.0	11.6
High school: 4 years or more			
October 1952	43.3	39.9	50.6
March 1962	53.8	50.8	59.4
March 1972 a.	65.9	63.8	69.2
College: 4 years or more			
October 1952	8.0	8.1	7.7
March 1962	11.0	11.7	9.5
March 1972 a.	13.6	15.0	11.4

Source: U.S. Department of Labour (1972), Table 5, p.40.

Note: a. Data are for 16 years old and over.

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